GAS

ENGINEERING • UTILIZATION • PIPELINES • MANAGEMENT

AUG 11 1955

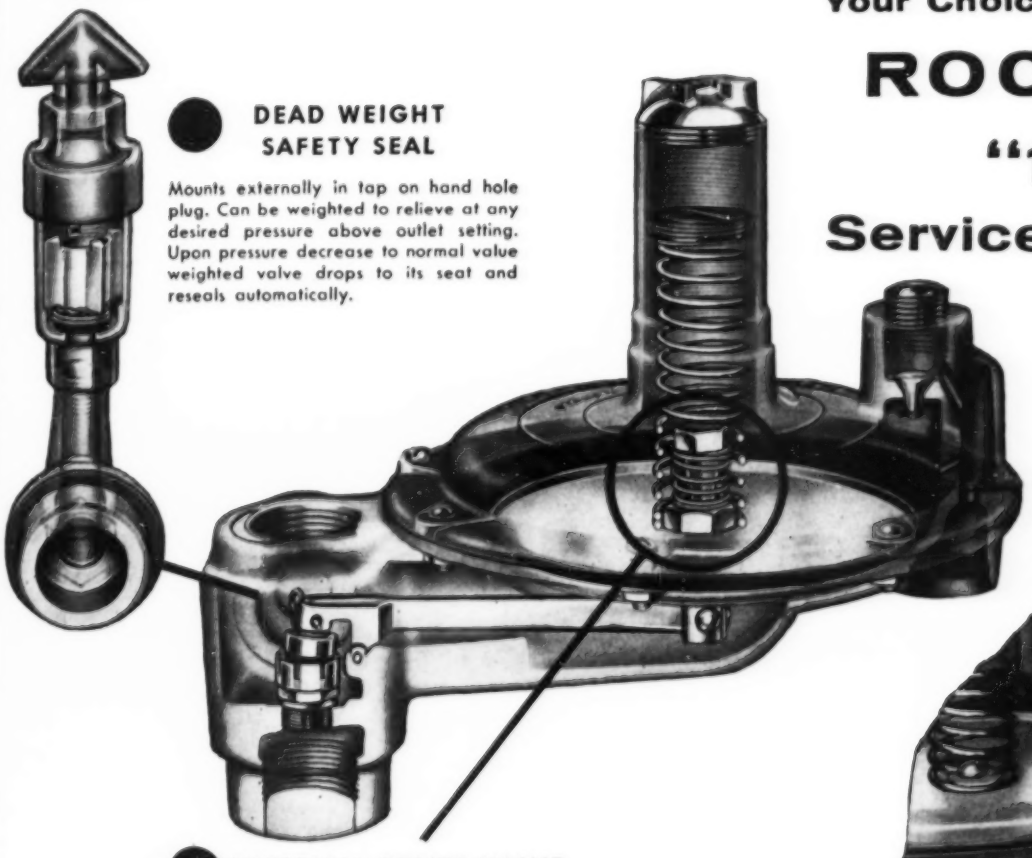
THE HERSCHER STORY

WASHINGTON STATE CODE (PAGE 121)

3 Effective Safety Seals

Your Choice and Option with

ROCKWELL "107" Service Regulators



DEAD WEIGHT SAFETY SEAL

Mounts externally in tap on hand hole plug. Can be weighted to relieve at any desired pressure above outlet setting. Upon pressure decrease to normal value weighted valve drops to its seat and reseals automatically.

INTERNAL RELIEF VALVE

Completely enclosed. Tamperproof and extremely sensitive. Relieves at 5 oz above any outlet setting. Utilizes excess pressure under entire main diaphragm to lift relief valve against relief valve spring. Reseals when pressure decreases to a value slightly below blowing point. Available with top vent for inside sets or large area, screened bottom vent for outside sets.

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STANDARD FEATURES

The "107" has the same basic design that has proved successful for many years. It is now better than ever because of improved materials, increased capacity, greater sensitivity and optional venting arrangements. *Write for literature.*

ROCKWELL MANUFACTURING COMPANY

Pittsburgh 8, Pa. Atlanta Boston Charlotte Chicago Dallas Denver Houston Kansas City, Mo. Los Angeles Midland New York Philadelphia Pittsburgh San Francisco Seattle Shreveport Tulsa

SPECIFY RELIANCE TYPE "P" Streamflow FOR SU[illegible] PERFORMANCE

Single valve construction eliminates possibility of knocking and insures streamflow of fluids with minimum turbulence.

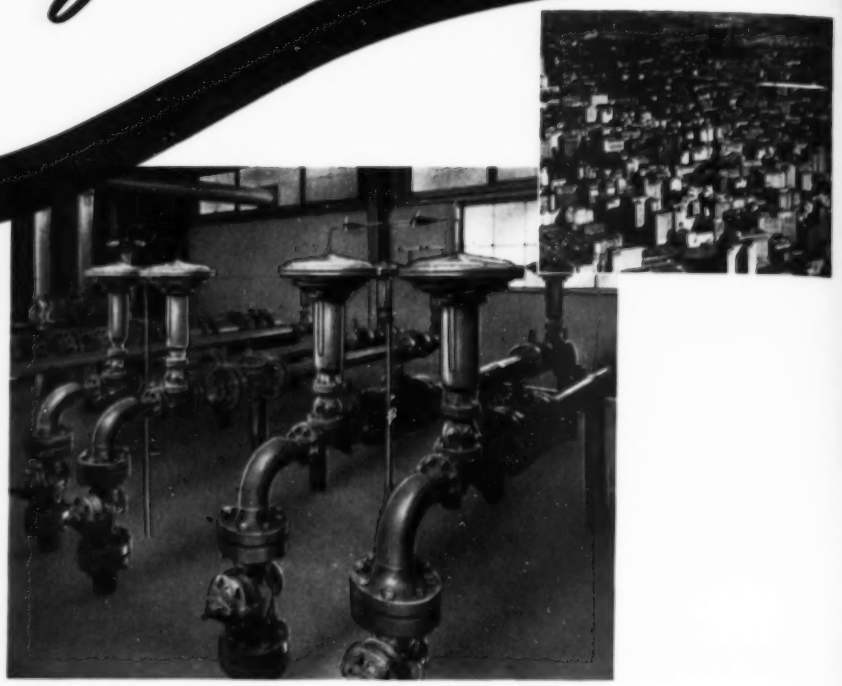
Expansion of fluids occurs downstream, thus relieving working parts from any scouring action or shock. A removable valve seat tube with long extension throat made of stainless steel, takes the force of expansion and turbulence.

Freezing of valve and other working parts is minimized due to expansion of fluid beyond these members. The velocity of fluid moving away from outlet of regulator minimizes the possibility of ice or frost formation and the force of expansion is gradually dissipated over a large area.

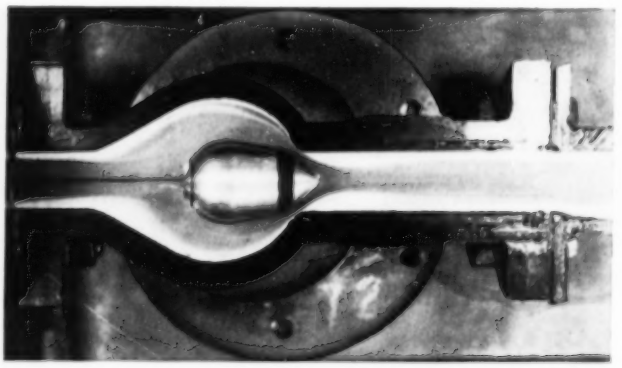
The power for valve operation is transmitted from a conventional type of diaphragm chamber to a cam member which actuates a bell crank carrying the valve. The valve is self-centering with orifice throat and operates on a ball and socket joint which gives perfect alignment.

ALL RELIANCE REGULATORS are made from the best quality materials obtainable and their dependable performance has been proven by the operating results of thousands now in service.

You can rely on
RELIANCE REGULATORS
For complete data, request
Bulletin No. 42-C



A battery of 2 inch large capacity type "P" streamflow *gas pressure reducing regulators, instrument controlled, on a large western distribution system.*



Sectional view of streamflow *characteristics—valve in open position. Note curvature of fluid flow in* streamlined *movement and clear converging of stream discernable at outlet throat.*

AMERICAN METER COMPANY
INCORPORATED (ESTABLISHED 1836)

RELIANCE REGULATOR DIVISION
ALHAMBRA, CALIFORNIA

TRENCHING 7 MILES of Indianola Avenue, a heavily traveled thorofare in Columbus, Ohio, called for a fast-moving job. The first step in opening the ditch was to line-cut and break a 7" course of paving brick topped with asphalt. Two 80 lb. breakers, powered by a Jaeger "125" Roto Air-Plus, were used for this work.

How Jaeger "125" Rotary speeds street work

On the above job, the instant-acting control of the Jaeger rotary, enabling it to maintain 100 lbs. minimum pressure under all air demands up to 125 cfm, made it possible to run two 80 lb. breakers at full efficiency, cutting and breaking an average of 400 linear ft. of 3 ft. wide trench (1200 sq. ft.) each 8 hours.

Because the higher efficiency of the Jaeger Roto enables it to operate at more economical engine speeds, fuel consumption on this job averaged only 1½ gallons an hour.

For big work, equally high efficiency is offered in the Jaeger Model 600 rotary. Jaeger reciprocating type compressors also continue to be available in all Jaeger "new standard" ratings with the exception of the 600 cfm size. For full information and comparative prices, see your Jaeger distributor — or send for Catalogs JC and JCR5.

For big work, Jaeger offers the Roto "600", illustrated below. It is the first fully efficient 600 cfm rotary compressor.

Model 600 Roto Air-Plus

THE JAEGER MACHINE COMPANY

661 Dublin Avenue, Columbus 16, Ohio

PUMPS • CONCRETE MIXERS • TRUCK MIXERS • LOADERS • PAVING MACHINES

GAS

31ST YEAR OF PUBLICATION

IN THIS ISSUE . . . .

At last it can be told — the story of how affiliated companies of Peoples Gas Light & Coke Co. brought to realization an ambitious plan for large-scale storage of natural gas in water sand. The Herscher story, in other words. Despite the many problems and the continuing small-quantity leakage from the strata, Herscher is now a successfully operating storage field. The story begins on page 107.

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BPA

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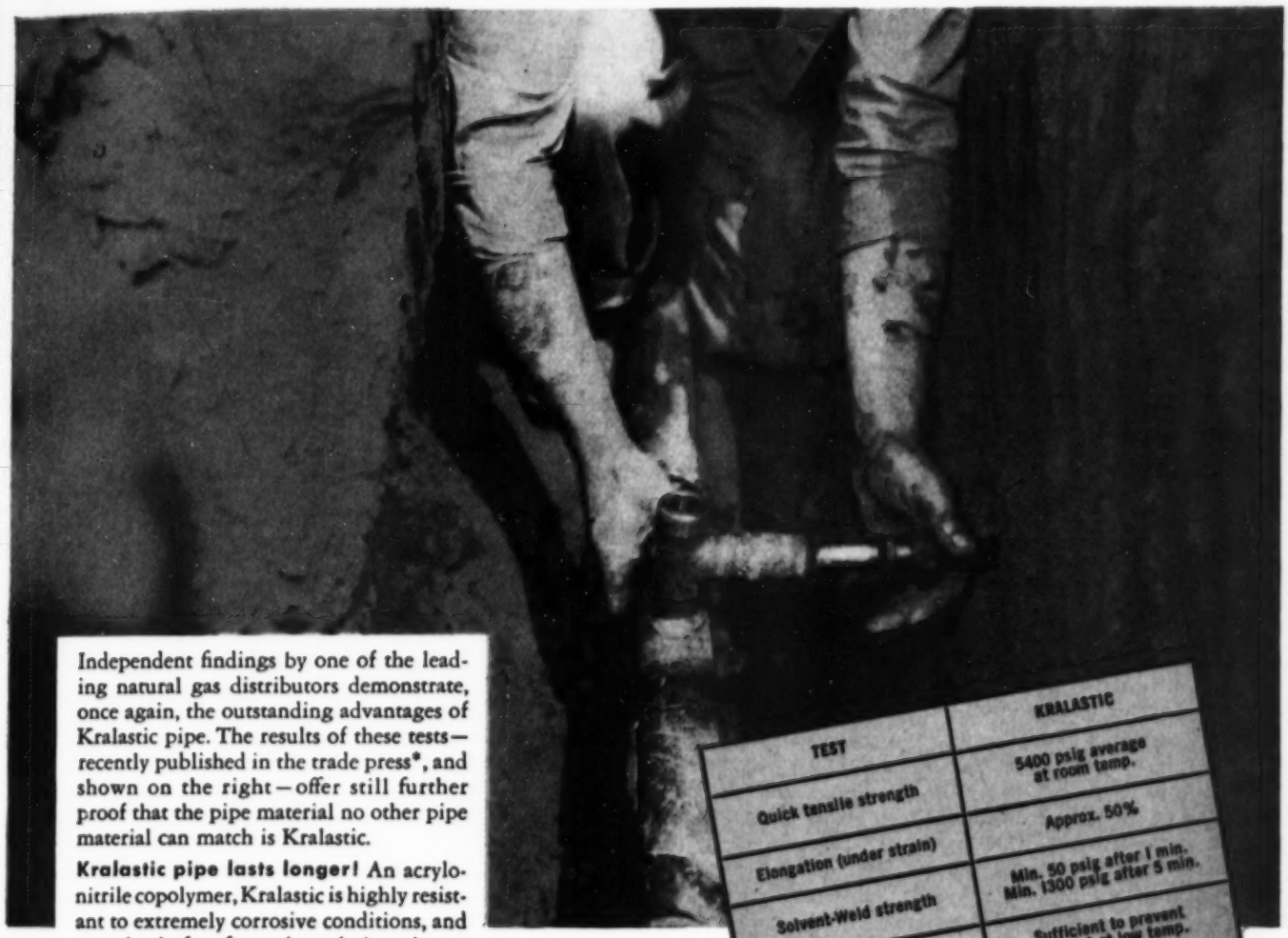
NBF

Gas Company's tests prove

Superiority *of* Kralastic *pipe!*



Independent findings by one of the leading natural gas distributors demonstrate, once again, the outstanding advantages of Kralastic pipe. The results of these tests—recently published in the trade press*, and shown on the right—offer still further proof that the pipe material no other pipe material can match is Kralastic.

Kralastic pipe lasts longer! An acrylonitrile copolymer, Kralastic is highly resistant to extremely corrosive conditions, and completely free from electrolytic action.

Kralastic pipe is easy to handle—easy to install! Kralastic pipe lends itself to snaking through existing lines, eliminating costly, time-consuming labor. Solvent welds can be made and tested in minutes, and because Kralastic is lightweight, one man can carry all that's necessary for the average home service.

Kralastic pipe is easy to maintain—exhibits no scale or interior build-up—is unharmed by alcohol or methanol frequently used to clear freeze-ups.

The first rubber-resin to produce successful plastic pipe, Kralastic has proved its unmatched advantages for carrying natural gas, brine, oil, water, and for many other applications. For additional information on how Kralastic® pipe can economically serve *you*, and for your copy of the test report, write to us, today.

*Gas Age, Oct. 7, 1954—Plastic Pipe Is Gaining Approval.

TEST	KRALASTIC
Quick tensile strength	5400 psig average at room temp.
Elongation (under strain)	Approx. 50%
Solvent-Weld strength	Min. 50 psig after 1 min. Min. 1300 psig after 5 min.
Elasticity	Sufficient to prevent pull-out at low temp.
Effect of alcohols and methanol	Very slight
Accelerated corrosion (buried in moist spent oxide)	No trace
Exposure to weather (after approx. one year)	Tensile = 20% above new Elongation = 20% below new

Naugatuck Chemical

Division of United States Rubber Company
Naugatuck, Connecticut

US RUBBER

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GAS Thermally Thinking

Hands off---or gloves on?

WE just never could quite see the logic in fighting with one arm tied behind your back.

Things like that are all right for juveniles, in tests of ability, but when you're fighting for something that is essential to your welfare, against someone who is just about your own size—and growing fast—it would appear on the face of it to be downright suicidal.

That's why we've reserved a ringside box for the big battle of the fuels now in progress in Kansas City. The hometown utility, Gas Service Co., has quite literally donned the "gloves" for a gas-vs-electricity slug-fest over which fuel is the cleaner, and the cheaper, for cooking. We all know who has right on his side, but it's obvious Gas Service Co. is not convinced that the general public does. So Gas Service is fighting the electric utility *with both hands.*

Ad Director Ray Ratliff tells us that the current round really began some time ago at the Greater Kansas City home show, where the local juice distributor began aiming his blows awfully close to the belt line. With its exhibit designed around the national "White Glove Clean" campaign, the electric company employed a number of young ladies to demonstrate electric cookery. After a spell at the range, each would rub a white-gloved finger across the bottom of the utensil and state to the audience, "You can't do this when you cook with a gas range!"

Rather than retiring to a back room to lick its wounds in dignified silence, Gas Service trotted out some white gloves of its own and every time a gasco girl would perform at a new Roper "nickel burner" range she would run a gloved finger across the bottom of the utensil and bring it forth as clean as ever. Since the gasco booth was located directly across the aisle from the electric display, it didn't take the kilowatt cuties long to drop the insinuation.

This particular bit of business was the signal for Gas Service to pull a trick of its own out of the hat. By the following day, the company had installed two large clock-like dials, each representing the cost of cooking with one of the competing fuels. "Comparative cost of gas cooking vs electric cooking" was the legend on a large sign across the dial faces. The hand on the "electric" face raced around seven times for every revolution of the "gas" dial.

The seven-to-one cost ratio also had its inception in the electric company's own promotion. "The average K.C. family cooks electrically for less than $2 a month," read the ads. Gas Service, without admitting that the statement was true, picked it up and used it in its own ads, declaring "IF this is a fact, then these same families can cook 7 years with gas for what they now pay to cook 1 year electrically."

(And, say the gasco ads—providing an extra needle to deflate the competition's false claims—"You don't need white gloves to cook with gas"—see page 59 for photos of the ads).

"We have always felt that products and services should be sold on their own merits without the necessity of running down other products or services in order to make a sale," says Ray Ratliff. But when the kilowatters chose to sell competitively, Gas Service wasn't averse to meeting them on their own terms.

Too long have many gas utilities used dignity and something called "good taste" as a shield against the competition's barbs. A few well-placed barbs might well prove the adage about the best defense being a good offense.

Anyone else care to descend from Mt. Olympus and wrestle with a few mortals for a change?

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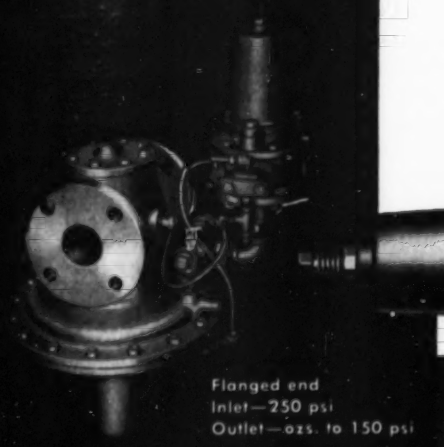
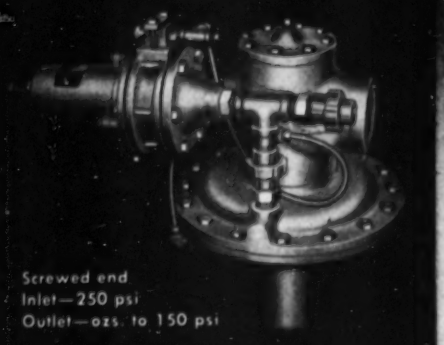
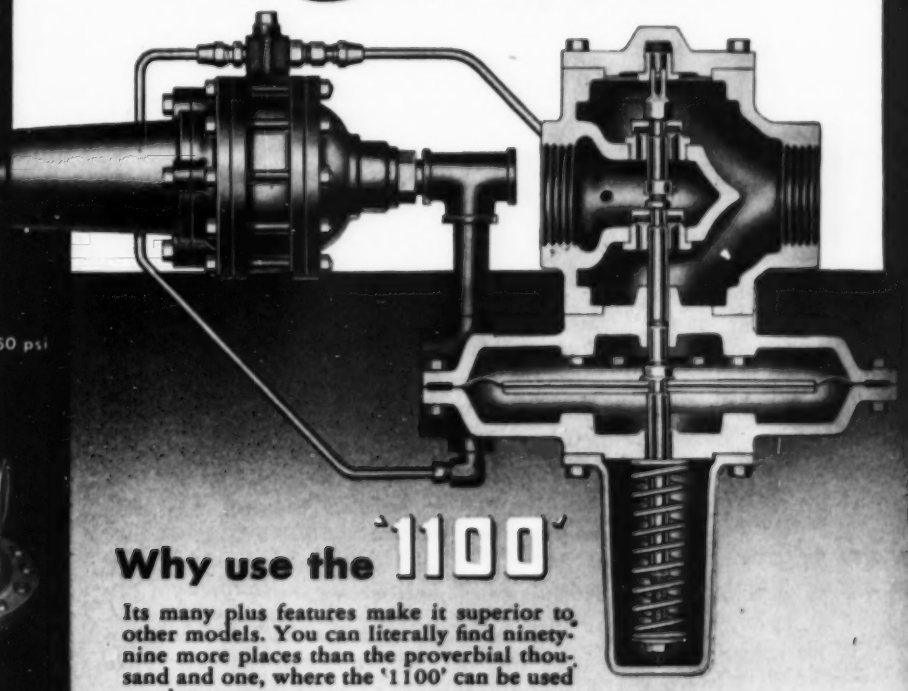
why? '1100' regulator



Flanged end
Inlet—250 psi
Outlet—ozs. to 150 psi



Screwed end
Inlet—250 psi
Outlet—ozs. to 150 psi



Why use the '1100'

Its many plus features make it superior to other models. You can literally find ninety-nine more places than the proverbial thousand and one, where the '1100' can be used to advantage.

One basic assembly-2"-screwed or flanged.

- **WIDER APPLICATION**—inches water to 150 psi controlled pressure—means less different types to stock and service.
- **GREATER CAPACITY**—balanced valve construction passes 114,000 CFH at 100 psi to ounces—replaces larger costlier regulators to reduce cost of whole installation.
- **PROVEN PERFORMANCE**—straight line control from minimum to maximum flow. Stable operation on quick changing loads, or with on-and-off controls. Fast low lock-up on zero flow.
- **SIMPLER CONSTRUCTION**—no intricate parts or delicate adjustments. All wearing parts easily replaced. Regulator or pilot can be serviced without disturbing the other.
- **EASIER INSTALLATION**—compact design requires little space for installation in any position. Just place in line and make one connection from regulator to outlet line.

ACCURATE CP MFG CO DEPENDABLE

Chaplin-Fulton
MANUFACTURING COMPANY

Bulletin 1100 with complete information sent on request.

54-1100

highlights

GAS SPOT NEWS, TRENDS, COMMENT ON GAS INDUSTRY AFFAIRS

Utility construction hits new high for first half

Using contract awards as a yardstick, the F. W. Dodge Corp. reports a new high in construction activity for January-June. Awards for construction of "private and public utilities" totaled $684,772,000, 38% ahead of last year and well above the first-half record established in 1952. All categories were up, Dodge found—except for gas plants and a "small miscellaneous group."

More than a billion was spent last year

AGA has a new figure—$1055 million total expenditure for construction of gas transmission and distribution company facilities for the year 1954. But that figure will fade by comparison to the near-record $1385 million prophesied for the current year. The association's latest survey shows that 1951 led all years with $1462 million outlay; that the four year period 1951-1954 saw an aggregate expenditure of $4933 millions, compared to current estimates for the next four years, 1955-1958, of $4315 million; that 1956, taken individually, should hit $1205 million, well ahead of last year but below the current year. Transmission construction outlays are expected to be 'way up this year—from 1954's $389 million to $720 million.

First-half appliance sales show gratifying gains

Closing their books on the first six months of 1955, GAMA members reported sharp gains all along the range of appliances. Water heaters showed a healthy 23.3% jump over 1954, from 1,130,300 in the first six months of last year to 1,393,500 this year. Ranges went from 988,600 in 1954 to 1,095,800, a 10.8% gain. Furnaces soared 40.3%, up from 251,800 in 1954 to 353,200. Boilers were up from 28,300 to 30,400, a 7.4% rise. Only conversion burners took a tumble, slipping from 81,800 to 56,900—a 30.4% drop.

Manufacturers veto 1956 GAMA exhibition

No show at Atlantic City next year, was the decision of nearly 600 manufacturer members of GAMA covered in a recent poll. Historically an every-other-year event held in conjunction with the AGA convention, the show was first called off in 1954. Two years from now GAMA will run another poll to make a decision on 1958.

"Zone rate" rehearing denied

The May 20 decision of FPC declaring Northern Natural Gas Co.'s uniform rates for its entire system to be "unduly discriminatory and preferential," and ordering Northern to split its system into three price zones, was upheld by the commission when it denied requests for rehearing. Northern, Minneapolis Gas Co., and 11 other parties to the proceedings had urged the reconsideration. (This very important, precedent-setting case is reviewed on pages 11-12 in this issue.)

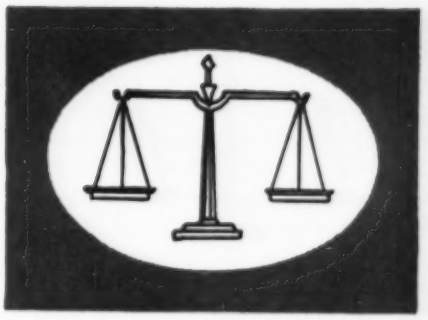
Is loss of assigned radio frequencies threatened?

AGA fears the eventuality its communications committee warned about late last year may come to pass if FCC adopts rule changes advocated by communications common carriers. "In the face of the AGA resolution," American Telephone & Telegraph Co., Rural Electrification Administration, U. S. Independent Telephone Association, and others seek FCC approval to use radio frequencies allocated to gas, electric, steam, and water utilities, AGA warns. "Use of such frequencies, it is claimed, is required in the construction and maintenance of common carrier communications routes. On June 30 FCC announced it favored rule changes advocated by communications common carriers. Comments are due by Sept. 16 . . . This is the step vigorously opposed by the communications committee resolution."

Mitchell, Zachry head up AGA slate

Nominees for officers for the 1955-56 AGA association year include Dean Mitchell, president of Northern Indiana Public Service Co., for president, and C. H. Zachry, president of Southern Union, Dallas, for first vice president. A. W. Conover, president of Equitable Gas, Pittsburgh, is the choice for second vice president, and Vincent T. Miles, treasurer of Long Island Lighting Co., Mineola, is tabbed for another term as AGA treasurer.

FPC prescribes gas rate zones for Northern Natural



THE FPC recently authorized rates for the Northern Natural Gas Co. intended to produce annual revenues of more than $86 million. FPC, contrary to the pipeline company's request and the presiding examiner's decision, prescribed three gas rate zones related to the mileage gas is transported to the various market areas. In most former cases in the United States, FPC had ordered system-wide rates. In this case, however, the commission concluded that Northern's identical rates to all customers, especially when the points of delivery were 600 miles apart, produced undue discrimination.

The commission declared that, "It is a simple economic fact that the delivery cost of natural gas increases in close proportion to the length of the transmission line of any given size." The commission added that, unless other circumstances are present that outweigh the importance of the length of transportation required to make the delivery, the distance factor becomes the prime determinant of the cost of rendering service. FPC then found that no circumstances were present in the case to counterbalance the distance factor.

Northern's pipeline system is about 800 miles long, extending from the Panhandle field in Texas and the Hugoton field in Kansas and Oklahoma to a point near the twin cities of St. Paul and Minneapolis. Northern also obtains large volumes of gas from the Permian Basin Pipeline Co., its subsidiary, which uses a pipeline extending 400 miles.

Natural gas transported through this pipeline system is sold to other utilities in Kansas, Nebraska, Iowa, South Dakota, and Minnesota for resale to consumers in those states. The rates charged by Northern for jurisdictional sales have historically been uniform regardless of the distance from the source of supply. Northern was joined in its opposition to the establishment of rate zones and rate differentials by the State of Minnesota, Minneapolis, St. Paul, Northern States Power Co., Minneapolis Gas Co., Minnesota Valley Natural Gas Co., Western States Utilities, Iowa Public Service Co., and Iowa Electric Light & Power Co.

The opponents of zoning contended that there should be no change in Northern's long continued practice of maintaining uniform rates throughout its system, with a minor area exception, and of rolling-in to such uniform rates additional costs as incurred. These advocates tried to demonstrate that the large volume of gas distributed on Northern's system has benefited all of Northern's customers through lowered transportation costs. In addition they urged that the large volume sales made near the end of the pipeline system have benefited customers closer to the source of gas supply because those customers enjoy a lower unit transportation cost than they would without those large quantity sales on the system. Those opponents concluded that by the uniform rate all of Northern's customers share equitably in the cost.

The opponents to the zoning method contended also that an increase in rates to some of the distributors, which would result from the establishment of zone rate differentials, would result in the loss of interruptible industrial sales, and that such a loss will cause an increase in the demand charge by which all of the firm customers on Northern's system will be injured. The loss of sales was predicted because such an increase in rates would price natural gas out of the competitive market for present industrial customers.

Those against zoning claimed that the factor of distance of transportation is offset by the fact that sales made in Minnesota near the end of the pipeline system have benefited customers near the source of supply. The commission answered this contention by saying that this is another way of stating the generality that for any given length of pipeline having any given load factor, the larger the line the lower the unit cost of gas. The commission added that this results from the fact that while the cost increases approximately in proportion with the diameter of the pipeline, the capacity increases more than the area, so that the capacity of a 24-in. diameter pipeline is about three times that of a 16-in. line.

The commissioners then stated that they were inclined to the opinion that sales in Minnesota benefit customers elsewhere on the pipeline system by contributing to the great quantity of gas handled, and the lowering of the unit cost of transportation. The commission noted that jurisdictional sales in Minnesota approximated 45% of the total of such sales. FPC, however, observed that jurisdictional sales in other states would make an equal or greater contribution to lowered transportation costs.

The commission added that it is important to consider the distribution of the load on the pipeline system as a part of the subject of relative contributions made by different markets to the cost of transportation. It noted that eight municipal areas accounted for 71% of total jurisdictional sales, and that the miles of transportation required to make the deliveries at these eight points range from 448 to 803. It was considered significant that more than 50% of the jurisdictional sales required transportation through Northern's pipeline system for a distance of less than 650 miles. The commission then found that there is no concentration of sales in a single area on the pipeline system that would overcome the arguments of those in favor of zoning and that the distance of transportation is the controlling factor in this case.

FPC emphasized the fact that the an-

nual load factor of sales in Minnesota is lower than the system average for jurisdictional sales and the lowest of any state served by Northern. The commissioners continued by declaring that load factor is important because for any given length and size of natural gas pipeline the delivery cost per thousand cubic feet of gas increases as the load factor at which the pipeline is operated decreases. That general statement gives expression to the mathematical fact that higher utilization of any capital facilities involving fixed costs will result in declining unit costs.

FPC summed up its analysis by asserting that although the large volume sales in Minnesota undoubtedly contribute to a lesser unit cost for transportation, the lower load factor of Minnesota sales has a converse effect.

The FPC staff was joined by Central Electric & Gas Co., Council Bluffs Gas Co., and the Metropolitan Utilities District of Omaha in contending that Northern's uniform system-wide rates to all resale customers, excepting an area near the Hugoton field, were unduly discriminatory.

It was disclosed that the cost of transportation represented 55% of Northern's total cost of service. The advocates of zoning contended that Northern's uniform system-wide rate practice required communities located near the source of gas supply to subsidize those communities located a long distance from the source of supply. It was argued, therefore, that the subsidizing communities incurred an economic disadvantage, which is forbidden by the Natural Gas Act.

The FPC staff conceded that factors other than distance of necessary transportation should be considered such as load distribution, volumes of gas sold, and load factor of sales, but that the distance that gas is transported to the various points of delivery is a primary cause for the resulting transportation costs. The staff contended that there were not factors to offset the differences in transportation mileage and related costs and, therefore, the markets closer to the source of gas supply involve lesser transportation expense than the most distant markets, so closer markets are entitled to lower rates.

FPC was convinced by the staff's evidence and decided that there were no circumstances in this case to counterbalance the distance factor and that the distance of transportation required to make deliveries at various geographical points by Northern reflected with reasonable accuracy the relative cost of providing natural gas service to customers. The commission condemned Northern's uniform rate for all customers because it resulted in "the shifting of transmission cost of those whose service requires its incurrence by reason of the greater transportation distances to others who are not responsible for such cost and who are not benefited correspondingly."

The presiding examiner in his initial decision in this case concluded that Northern's uniform system-wide rates were not demonstrated to be so unjust, unreasonable, unduly discriminatory or preferential as to violate the Natural Gas Act. He also concluded that the public interest does not now require the establishment of service zones or zone rates upon the interstate natural gas pipeline system of Northern Natural. The FPC overruled the examiner's decision after finding Northern's uniform rate practice to be unlawful, discriminatory and preferential.

FPC then proceeded to eliminate that "discrimination" among customers. The commissioners recited the theoretical ideal of a rate structure to assess each point of sale with the total of the various cost components incurred by the pipeline company in rendering the gas service to each point. Drawing on its experience, the commission said that such perfection would be delusory and impracticable from both the management and regulatory viewpoints. FPC declared that in the circumstances of this case the only practical and reasonable approach to a fair solution was the fixing of service zones with differences in rates charged in those geographical areas.

The commissioners rejected each of the methods of zoning proposed because of inequities that would result. The commission adopted the objective that zones should include as large an area of service as is consistent with equitable treatment to all customers. FPC then prescribed three zones on Northern's pipeline system which were nearly equal so far as transportation distances were involved.

The FPC staff in distributing the total cost of service to the zones first determined the average weighted transportation miles required to carry purchased and produced gas from the various sources to a common point on the pipeline system which was the last point of input. The number of transportation miles from the source of supply to each sales delivery point was then ascertained. Transmission demand miles were computed by multiplying the mileage for each delivery point by the three-day system peak average sales at each point. Transmission commodity miles were computed by multiplying the mileage to each delivery point by the annual sales for that point. These data were grouped by zones and by classes of service.

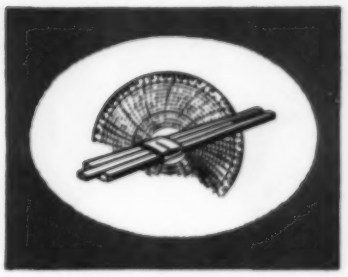
Under the staff's procedure the unit cost of service on a system-wide basis was determined for each function and allocated to zones and classes of service. Production costs were allocated to all sales in proportion to the volume of yearly sales. Transmission costs were allocated by the computed demand and commodity Mcf-miles. Distribution and customers accounting and collecting costs were assigned to zones according to the number of delivery points. Sales promotion expense was allocated to zones in accordance with the yearly volume of sales. Drilling and pumping sales were assigned transportation costs by Mcf-miles based upon the average distance of such sales groups from the gas supply source.

The commission appraised this evidence of its staff and said, "For the purposes of this case wherein we are attempting to arrive at a sound and equitable basis for establishing for the first time a differential in rates in separated areas of a system which has not heretofore had zone rates, we find the theory of the cost allocation procedure advocated by the staff to be particularly appropriate." The commission continued by stating reasons for making certain minor modifications in the precise manner in which the staff's theory was applied in this case.

The commission authorized Northern at its option to maintain in the rate schedules filed in compliance with the order a uniform commodity charge throughout its system, and to adjust the demand component of the rates to provide a differential between zones of approximately two cents per thousand cubic feet at a 70% load factor.

The commission concluded its decision by asserting that in the circumstances of a particular case, and as it did in this case, it could determine and fix the differential in rates that is reasonable and necessary to eliminate unlawful discrimination while permitting the company to decide how such differential shall be implemented. ■

technical trends



• By GUY CORFIELD

Shale oil still in picture

In the constant review of national and continental fuel resources, there is always in the background the vast potential supply of oil in the tar sands of northern Canada and the shale deposits of Colorado. Both the Federal government and the petroleum industry (principally the Union Oil Co.) have for many years been studying the Colorado oil shale on laboratory and pilot plant basis. Recent reports indicated that oil from this source was not considered to be competitive with current petroleum prices, but that if its production could become economic there was enough information available to permit commercial operation. Consequently, the Bureau of Mines shale oil research plant at Rifle, Colo., is scheduled for shut down, although there is considerable opposition to this in Colorado, Utah, and Wyoming.

Meanwhile the Union Oil Co. has announced plans for a $5 million plant near Rifle to extend its research to full scale production. This plant will handle 1000 tons of shale and produce 800 to 900 bbl of shale oil daily, from a 50,000-acre deposit owned by Union which is said to contain 50 billion bbl of oil.

Solar Energy

As the consumption of fuel from fossil sources (gas, oil and coal) increases so that the end of the world's supply may be in sight, and scientists are even predicting the finite period over which atomic energy producing minerals will last in terms of known supply and utilization methods, and as a future shortage in world food seems possible, increasing attention is being given to solar energy, which reaches our earth in such bounteous quantities.

Earlier items on this page have described houses heated by trapped and stored solar radiation, and mirrors that reflect and concentrate the sun's rays to develop furnace temperatures at focal points. Solar evaporation is another way of putting the sun to work and, of course, if the secret of the way in which chlorophyll in living plants converts water and carbon dioxide into carbohydrates can be found, the specter of famine would vanish. Means are even beginning to appear, as seen in the silicon solar battery of the Bell Telephone Laboratories, of directly converting sunlight into electric energy.

As a tangible sign of increasing interest in this subject, a World Symposium on Applied Solar Energy has been arranged by Stanford Research Institute and the Association for Applied Solar Energy, to be held at Phoenix, Ariz., on Nov. 1-5 of this year. The general session of the conference will include discussions on domestic uses of solar energy, solar machines, food and feed from the sun's energy, and direct conversion of solar energy. Experts in the field will speak on space heating and cooling, solar water heaters, architectural problems, high temperature furnaces, stills, derivation of mechanical energy, algae culture, photovoltaic cells, and other mechanisms for procuring energy from the sun.

Scientific developments at U. S. Bureau of Standards

Earlier this year the National Bureau of Standards at Washington, D. C., held an open house and exhibited its new Betatron and Gamma Ray Laboratories, as well as 14 other units, to several hundred leaders in science, industry, government, and education. The Betatron Laboratory houses a 50-million volt betatron and a 180-million volt synchrotron, which enable the production of high-energy X-rays for study of standards and measurement methods for their safe application in medicine, industry, and nuclear physics. The Gamma Ray Laboratory permits the bureau to meet growing scientific and technical requirements for calibrating radioactive materials, and instruments for their use, growing out of advances in application of atomic energy.

A radiation monitor was exhibited that automatically measures radiation intensities in the vicinity of a nuclear explosion and transmits the data by radio to any selected point. Another demonstration showed the conversion of high-penetration X-rays into visual televised images so that the audience could clearly see the moving piston, piston rod and other internal parts of an operating engine.

Other demonstrations included: Precision measurement of length, to an accuracy of 2 millionths of an inch per inch; measurement of supersonic speeds up to twice that of sound; standards and measurement of very high temperatures; exploration of fatigue of metals, by means of fluctuating loads applied to specimens in the form of bars, plate, sheet, and wire; investigation of properties of matter at temperatures down to 422° F and lower; operation of high speed electronic computers; measurement and matching of colors; precise and rapid analysis of metals and alloys, by automatic spectrometers; evaluation of thermal properties of insulating materials; machines for measurement of forces, including compression testing up to 10 million lb; and applications of high-speed impact tests to determine the strength of fibers, yarns and fabrics under repeated stress such as applied to automobile tire fabric, industrial sewing thread, etc.

There is probably not general realization of the extent to which this great national institution provides a background of research, standardization, and technical and scientific guidance to all phases of our education, industry, and commerce.

POWER

DELCO-REMY A.C. GENERATORS FOR EXTRA-HEAVY ELECTRICAL LOADS

Delco-Remy's new 6- and 12-volt A.C.-D.C. charging systems are the answer to the *extra-heavy* electrical demands of late-model municipal or public utility trucks, cars, and other vehicles equipped with two-way radio, floodlights, or other special electrical units. High wattage output is ample for heaviest electrical loads . . . generators pick up discharged batteries quickly in emergencies. Delco-Remy A.C.-D.C. charging systems are unexcelled at curb-idle . . . furnish up to 180 amperes at higher engine speeds . . . are dependable under the most rugged operating conditions at all engine speeds.

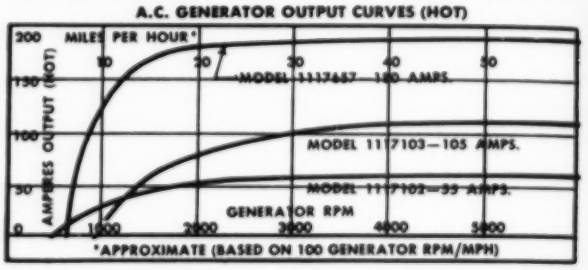
Application packages for both 6- and 12-volt generators, complete with installation instruction sheets for popular makes of cars and trucks, are available. Conversion is simple. See your nearest United Motors distributor for additional data.

A.C. GENERATOR PERFORMANCE DATA (HOT)

Model	Volts	Cut-In RPM	Curb Idle Amperes *	Maximum Amperes	Power Watts SAE	Recommended For
1117102	12	525	39	55	825	All speeds.
1117103	12	960	5	105	1575	All speeds.
1117657	12	550	130	180	2700	All speeds.
1117062-3-4	6	750	38	90	720	All speeds.

*APPROXIMATE (BASED ON 1000 GENERATOR RPM)

A.C. GENERATOR OUTPUT CURVES (HOT)



*APPROXIMATE (BASED ON 100 GENERATOR RPM/MPH)

DELCO-REMY D.C. GENERATORS FOR MEDIUM-TO-HEAVY ELECTRICAL LOADS

Delco-Remy's 6- and 12-volt extra-output D.C. generators are an economical answer to the electrical needs of late-model municipal or public utility trucks, cars . . . other vehicles with additional lights, two-way radios, or other special electrical equipment in medium- to heavy-duty service in suburban areas. Delco-Remy extra-output D.C. generators are low in cost, simple to install, economical to maintain. Performance data on Delco-Remy extra-output D.C. generators are shown at the right.

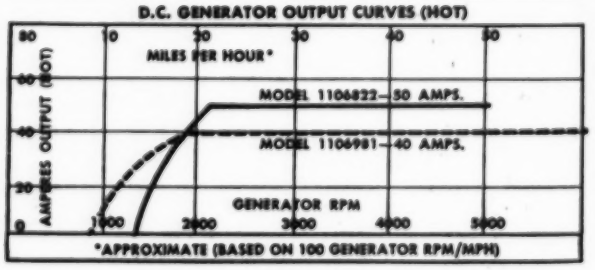
For further details and application data, see your nearest United Motors distributor.

D.C. GENERATOR PERFORMANCE DATA (HOT)

Model	Volts	Cut-In RPM	Curb Idle Amperes *	Maximum Amperes	Power Watts SAE	Recommended For
1106822	12	1300	0	50	750	Low to Medium Speeds
1106981	12	825	14	40	600	Low speeds & idling.
1106757	6	820	†	55	440	Medium to high speeds.
1106758	6	560	26	45	360	Medium Speeds and Idling
1106977	6	610	28	55	440	Low speeds & idling.

*APPROXIMATE (BASED ON 1000 GENERATOR RPM)

D.C. GENERATOR OUTPUT CURVES (HOT)



*APPROXIMATE (BASED ON 100 GENERATOR RPM/MPH)

Delco-Remy
ELECTRICAL SYSTEMS

DELCO-REMY • DIVISION OF GENERAL MOTORS • ANDERSON, INDIANA

GAS

AUGUST 1955

GAS exclusive

The arguments presented here were developed as the result of several years of study of the design of gas distribution systems.

The design of a distribution system that will deliver predetermined quantities of gas at a pre-selected pressure is relatively simple. The real test of a system design is its successful operation over an extended period of time for which meter growth and weather conditions cannot be accurately prophesied.

Obviously, the difficult problems of gas load and weather forecasting can be overcome if the requirements of economy are ignored; however, it is basic to all engineering that the desired results be accomplished for the lowest price possible.

An attempt has been made to provide a guide for distribution system design that will satisfy these demands, and give satisfactory operation for a period of many years, consistent with economy.

The ideas developed in this article are the author's, and are not the adopted policy of the Southern California Gas Co.

Selection of an optimum operating pressure for a medium pressure distribution system

By **ROBERT I. MOORE** • Southern California Gas Co., Los Angeles

THE selection of the optimum operating pressure for medium-pressure distribution systems has been a subject of much discussion since the introduction of natural gas and the practice of transmitting gas at high pressure. The lack of agreement as to the optimum operating pressures is probably the result of several factors. Various operating problems in different areas have influenced the choice of district regulator settings; different theories are held on leakage and hazard control; and obviously the optimum for one area is not the best pressure for some other area.

An analytical approach to this problem is certainly justified. Rather than ask the question, "What is the optimum operating pressure?" the engineer should ask, "What desirable characteristics should be included in the design of a medium pressure gas distribution system?"

These operating characteristics are:

(1) A maximum pressure that does not necessitate dual stage regulation at the customer's premises.

(2) A maximum pressure that is compatible with the strength of the pipe used.

(3) The ability to perform maintenance operations with relative ease and safety.

(4) An operating pressure that provides a reasonably safe system from the standpoint of hazards resulting from leakage.

(5) An inexpensive pipeline system.

(6) A factor of safety that will provide pipeline capacity for unexpected peak loads.

(7) The ability to increase the capacity of the system to allow for changes in the design peak load, without installing more or larger mains.

The choice of the optimum operating pressure will be a compromise between these somewhat conflicting desirable features.

By definition, the upper limit of a medium pressure system is 60 psig. Since this pressure is also the limit for single stage regulation at the customers' premises, dual stage regulation is not required for a medium pressure system.

The 60-lb pressure limit is also satisfactory from the standpoint of pipe strength; standard-weight or thin-wall pipe is well within the safe limit when used with pressures up to 60 psig.

Maintenance operations—leak repairs, the use of pressure control machines, and tapping—offer no great difficulties with pressures up to 60 lb. However, these operations are somewhat easier, and considerably safer, at pressures below 30 psig. Therefore, other things being equal, the lower pressure range would be desirable.

Obviously, the higher the pressure, the greater the leakage through a given size hole in a pipeline. Tests have indicated that underground leakage is proportional to the gauge pressure. These observations would suggest that the lowest possible pressure would provide the safest system. However, a review of accidents that have occurred in the gas industry during the past few years indicates that the most hazardous conditions often occur in low pressure areas.

Perhaps the best approach to the problem of leakage control would be to design the system on the basis of other desirable characteristics. Then a maintenance program should be planned with due consideration of the physical conditions, and the pressure used.

The pipeline system requiring the smallest initial investment would be achieved by the smallest diameter pipes possible. This would require pressure regulators set at 60 psig or the highest pressure available, whichever is the least. Pipelines in this system would be sized so that peak hour load conditions would result in a minimum downstream pressure of the lowest allowable pressure for supply to a customer.

The undesirable features of this system are apparent: customer outages would occur whenever a load in excess of the design load was experienced; the high source pressure would impose the greatest difficulty of operation and

"The optimum district operating pressure depends on the selection of the additional capacity factor . . . The sizing of the pipelines in the system will depend on the selection of the overload factor."

leakage control; and it would be impossible to increase the district regulator pressure in order to provide greater capacity than the requirements anticipated when the system was designed.

The obvious inadequacies of this system point up the most important characteristics a well-designed gas network should have: a safety factor to insure operation over unexpected high load conditions, and additional capacity to allow for increases in the design peak load.

The first of these features, the safety factor or overload factor, can be provided by sizing the pipe so that during periods of anticipated peak loads, the minimum downstream pressure is higher than that required to supply a customer.

The second feature, the additional capacity factor, should be provided by designing the system with a district regulator setting lower than the available source pressure.

It therefore resolves that the optimum district operating pressure depends on the selection of the additional capacity factor, with due consideration of the requirements for safety and ease of operation. The sizing of the pipelines in the system will depend on the selection of the overload factor.

Were future load predictions accurate, the distribution system could be most economically designed with district regulators set at the maximum available source pressure, not exceeding 60 psig, but experience has proved the wisdom of anticipating larger loads than those predicted for any area.

Loads in excess of those predicted could be supplied by three methods—installation of parallel headers, premature replacement by larger size mains, or excess capacity built into the original system. A comparison might be made of the dollar value of each means of supplying additional loads; however, the method of building extra capacity into the system has definite advantages over the spending money when additional loads occur.

Unpredicted loads—industrials, multiple unit building resulting from rezoning, new types of appliances, etc.—may occur when a material or manpower shortage exists, for example, during a war. The experience of the past few decades indicates that two major wars may occur during the normal life of a pipe. It would therefore be wise to design distribution systems capable of operation with loads in excess of those prophesied.

The amount of surplus capacity that should be included in the design data for a distribution system depends on consideration of several factors that would vary for different areas. To determine the additional capacity factor (F_{AC}), that should be applied to the calculated design load, consideration should be given the following:

(1) Is the area expected to reach saturation during the lifetime of the pipe?

(2) Does the area lend itself to industrial development?

(3) Is the area development likely to deviate from the assumed growth pattern?

(4) Is rezoning likely to affect the meter concentration in the area?

The additional capacity factor discussed above is intended to provide adequate capacity in the system for deviations from the design load. These changes could probably be anticipated six months before their occurrence, and additional capacity would be provided by adjusting the district regulators to higher pressure settings.

A margin of safety or overload factor (F_O), should be used in the system design to provide for the extreme peak loads that might be experienced during unusually cold days. Determination of this factor will, of course, require a considerable amount of experience and judgment.

When district regulator pressures are adjusted to compensate for increased design peak loads, the original overload factor should be preserved. If a given overload factor is incorporated in the original design, the necessity for a higher district pressure at some later date does not affect the argument that supported the choice of the overload factor. Therefore, when district pressures are increased, the peak hour downstream pressure should also be higher.

Suppose a system is designed to operate with a district regulator pressure of 25 psig, and a downstream pressure of 15 psig. This combination will provide an overload factor of 0.45 or 45%. If a 25% increase in the design load occurred, and the district pressure were increased to 29 psig to provide the required additional capacity, the peak load downstream would continue to be 15 psig. However, the overload factor would then be only 30%. If, however, the district pressure were increased to 32.5 psig, the peak load downstream pressure would be 20 psig, and the required overload factor of 45% would be preserved.

The maximum available district pressure should be determined considering not only the maximum pressure available from trunk or transmission lines and the 60-lb medium pressure limit, but the effects on operation of the system and leakage control when the upper levels of the medium pressure range are used. The maximum available district pressure for system design purposes should therefore be the pressure that for ease of operation and safety should never be exceeded. This might well be less than 60 psig even when the maximum medium pressure limit is available.

The calculation of the optimum operating pressures for a medium pressure distribution system requires the selection of the maximum operating pressure, the additional capacity factor and the overload factor. The derivation of the factors is shown on the facing page.

Unfortunately, the solutions to the problems of distribution system design are not as simple as the derivations of these formulae. Agreement on the magnitude of the three unknowns, P_M, F_O, and F_{AC}, is difficult to achieve.

The value of P_M will be determined largely by existing gas supply conditions, but consideration must also be given the prevention of possible hazards, and ease of operation.

The determination of the overload factor, F_O, will probably excite less argument than the other variables in the formulae, because experience has indicated the magnitude of the extreme peak loads that result from unusually cold days. A reasonable value for the overload factor in southern California is 1.25. The factors used in other parts of the country should be based on local experience, and the correlation of accumulated weather and gas sendout data.

Probably the most controversial item in the formulae is the additional capacity factor, F_{AC}. The magnitude of this factor will be affected not only by the possible deviations from the design load, but will depend on the length of

Derivation of factors used in calculating optimum pressures

For derivation of the expressions for the optimum district pressure and minimum downstream pressure, the following nomenclature will be used:

P_1 — Optimum district operating pressure.

P_2 — Corresponding minimum downstream pressure.

P_M — The maximum pressure at which the district can or should be operated.

F_{AC} — The additional capacity factor expressed as a ratio of the increased design load to the original design load.

F_O — The overload factor, expressed as a ratio of the extreme peak load to the design peak load.

Q — The design peak load in cubic feet per hour.

K — A constant.

The flow of gas in a medium pressure pipeline network may be expressed by the formula:

$$Q = K\,(P_1^2 - P_2^2)^{.541} \qquad (1)$$

If the load were increased to F_OQ, then the downstream pressure would be atmospheric pressure or 14.7 psig. This condition could be expressed by the equation:

$$F_OQ = K\,(P_1^2 - 14.7^2)^{.541} \qquad (2)$$

The expression for conditions existing when the district pressure has been increased to supply the maximum additional capacity, and an extreme peak load is also being supplied would be:

$$F_OF_{AC}Q = K\,(P_M^2 - 14.7^2)^{.541} \qquad (3)$$

By raising equations (2) and (3) to the .541 power, dividing equation (2) by equation (3), and rearranging, we derive an expression for P_1:

$$P_1 = \sqrt{\frac{(P_M^2 - 14.7^2)}{\sqrt[0.541]{F_{AC}}} + 14.7^2} \qquad 4$$

An expression for P_2 may be derived by similar manipulation of equations (1) and (2):

$$P_2 = \sqrt{P_1^2 - \left[\frac{P_1^2 - 14.7^2}{\sqrt[0.541]{F_O}}\right]} \qquad 5$$

Equation (5) illustrates an observation made previously; that the selection of the optimum district regulator pressure is independent of desired overload factor.

To find the minimum downstream pressure (P_{2M}) for the conditions when the load is $F_{AC}Q$, and the district regulator pressure is P_M, substitute the appropriate pressures in equation (5):

$$P_{2M} = \sqrt{P_M^2 - \left[\frac{P_M^2 - 14.7^2}{\sqrt[0.541]{F_O}}\right]} \qquad 6$$

Sample problem: Designing for additional capacity

Suppose it is desired to design a distribution network to be supplied from high pressure trunk lines carrying gas at 100 psig. Assume that 40 psig is the maximum pressure at which the system should ever be operated. Let us further suppose that provision for additional capacity must be provided for loads 100% greater than the design loads, based on the possibility of rezoning from single to multiple residences. Also, experience has shown that extreme cold days may impose loads 25% higher than average peaks.

$P_M = 40$ psig (54.7 psia)

$F_{AC} = 2.0$

$F_O = 1.25$

To find the district regulator pressure P_1, use formula (4).

$$P_1 = \sqrt{\frac{P_M^2 - 14.7^2}{\sqrt[0.541]{F_{AC}}} + 14.7^2}$$

$$= \sqrt{\frac{54.7^2 - 14.7^2}{\sqrt[0.541]{2.0}}}$$

$$= 31.4 \text{ PSIA}$$

$$= 16.7 \text{ PSIG}$$

To find the downstream pressure during peak load periods use formula (5).

$$P_2 = \sqrt{P_1^2 - \left[\frac{(P_1^2 - 14.7^2)}{\sqrt[0.541]{F_O}}\right]}$$

$$= \sqrt{34.4^2 \left[\frac{31.4^2 - 14.7^2}{\sqrt[0.541]{1.25}}\right]}$$

$$= 21.8 \text{ PSIA}$$

$$= 7.1 \text{ PSIG}$$

The minimum downstream pressure, P_{2M}, that would occur during peak load periods if the district regulator pressure were increased to 40 psig to provide 100% additional capacity, may be calculated using formula (6).

$$P_{2M} = \sqrt{P_M^2 - \left[\frac{P_M^2 - 14.7^2}{\sqrt[0.541]{F_O}}\right]}$$

$$= \sqrt{54.7^2 - \left[\frac{54.7^2 - 14.7^2}{\sqrt[0.541]{F_O}}\right]}$$

$$= 33.9 \text{ PSIA}$$

$$= 19.2 \text{ PSIG}$$

Critical distribution pressures plotted against design load variables.

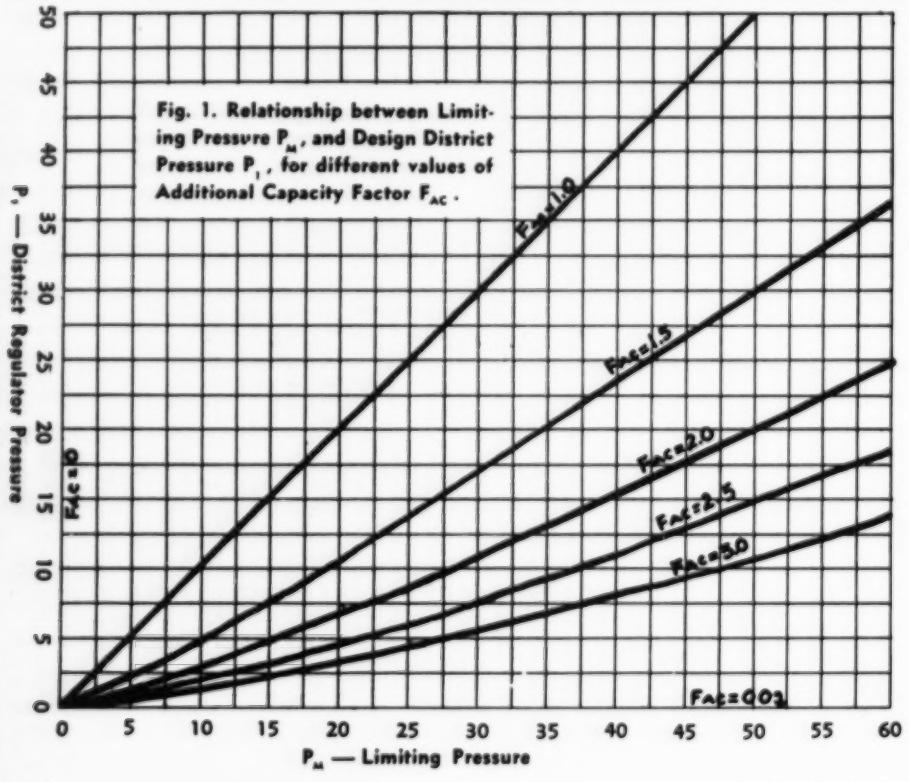


Fig. 1. Relationship between Limiting Pressure P_M, and Design District Pressure P_1, for different values of Additional Capacity Factor F_{AC}.
FAC=1.0
FAC=1.5
FAC=2.0
FAC=2.5
FAC=3.0
FAC=0.03
P_1 — District Regulator Pressure
P_M — Limiting Pressure
0 5 10 15 20 25 30 35 40 45 50 55 60

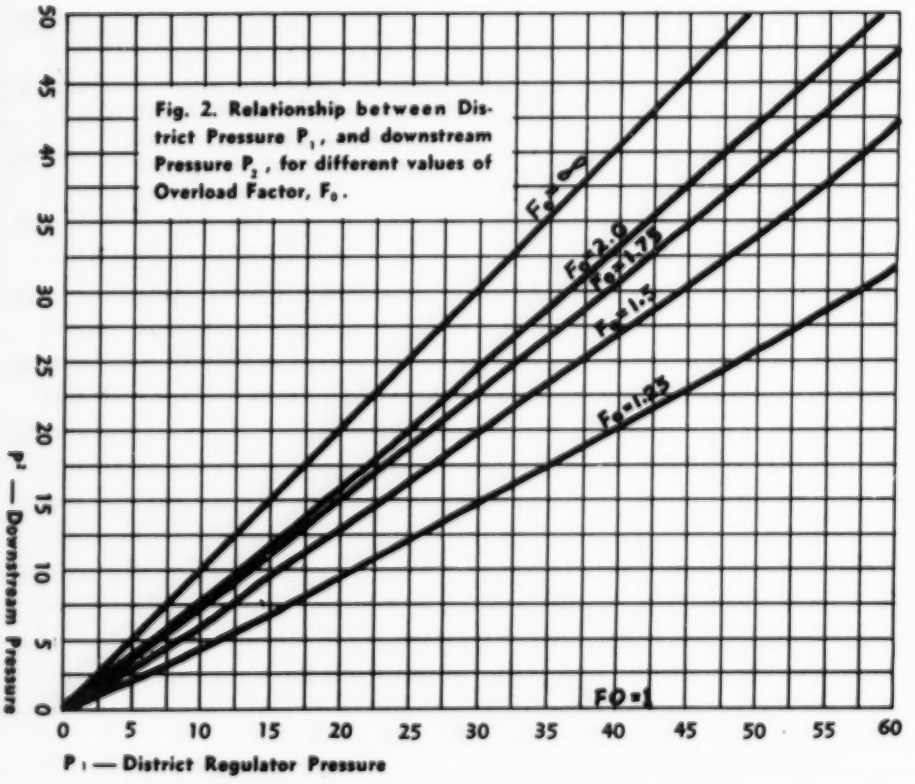


Fig. 2. Relationship between District Pressure P_1, and downstream Pressure P_2, for different values of Overload Factor, F_0.
Fo=∞
Fo=2.0
Fo=1.75
Fo=1.5
Fo=1.25
FO=1
P_2 — Downstream Pressure
P_1 — District Regulator Pressure
0 5 10 15 20 25 30 35 40 45 50 55 60

time for which load predictions are made, and whether estimates of the area growth are for the expected life of the pipe, or for a shorter period.

If a shorter period than the life expectancy of the pipe were used, it would be on the assumption that accurate predictions cannot be made for so long a period, or that an overlay of additional pipelines is contemplated at a later date. In either case, additional capacity over and above the predicted load for the design term should be provided, so that it will not be necessary to make large expenditures for which allowance has not been made. (For an example of how this might be applied, see example on preceding page.)

The graphs have been prepared to illustrate the significance of various combinations of operating pressures, and can be used as tools for the design of distribution systems.

Fig. 1 shows the relationship between the maximum available pressure, P_M, and the design pressure, P_1, for different values of the additional capacity factor, F_{AC}.

Fig. 2 shows the relationship between district regulator pressure, P_1, and the downstream pressure, P_2, for different values of the overload factor, F_O.

Figs. 3, 4, 5, 6, 7, and *8* show the relationships of the district regulator pressure and the downstream pressure for various values of F_{AC} and F_O. Each graph shows these relationships for a different maximum available pressure ranging from 10 psig to 60 psig.

A study of these graphs will illustrate very dramatically a common error in distribution system design—the dogmatic use of a combination of operating pressures with little or no regard for the resulting operating characteristics. The selection of the district regulator pressure and the minimum downstream pressure will determine the overload factor of the system, but the additional capacity will depend on the available pressure. Therefore, the maximum pressure at which the system should be operated should be determined before the operating pressures are selected.

The optimum district operating pressure might be defined as the most desirable pressure for operation of a distribution system. However, the calculation of the district pressure on the argument outlined in this article must take into account conditions that are themselves often far from ideal. Therefore, in most areas, the optimum pressure should be an ideal condition, the achievement of which would not be economically feasible.

With due consideration for the economic aspects of the problem, the district operating pressures should be determined for the conditions existing in any area, with modifications in the design when extensions or replacements are made, so that over the years, there will be gravitation toward ideal conditions. ■

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Relationships of district regulator pressures and downstream pressures with additional capacity and overload factors under limiting conditions.

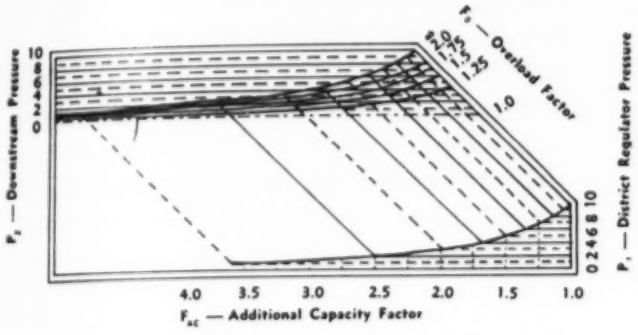


Fig. 3. Relationships of P_1, P_2, F_O, and F_{AC}, for limiting pressure of 10 psig.

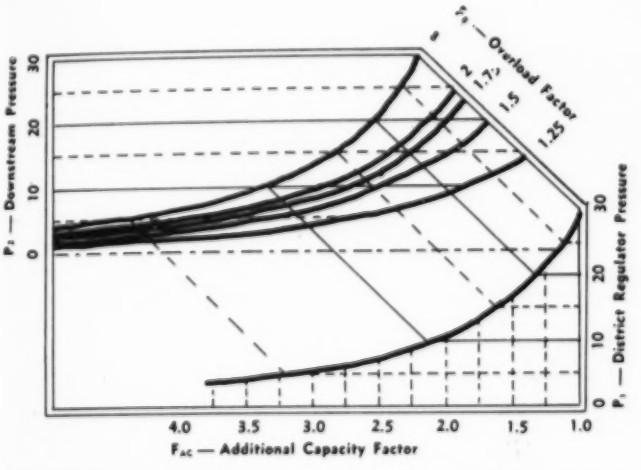


Fig. 5. Relationships of P_1, P_2, F_O, and F_{AC}, for limiting pressure of 30 psig.

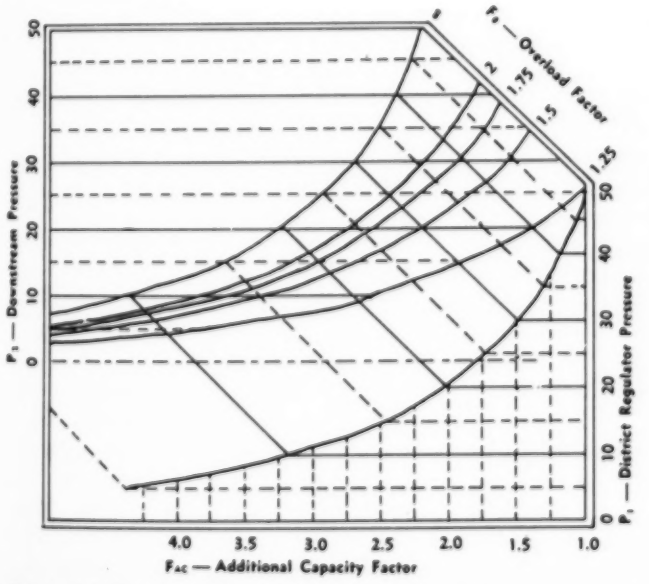


Fig. 7. Relationships of P_1, P_2, F_O, and F_{AC}, for limiting pressure of 50 psig.

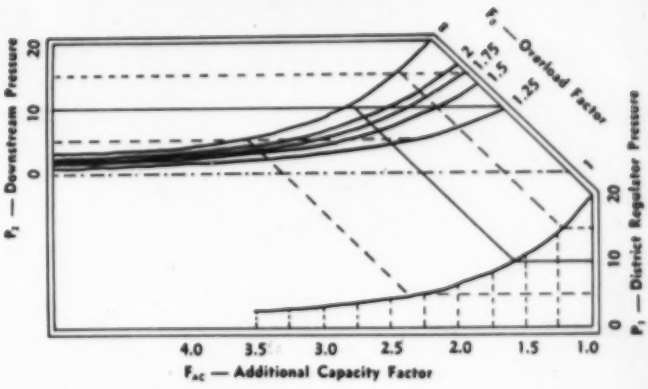


Fig. 4. Relationships of P_1, P_2, F_O, and F_{AC}, for limiting pressure of 20 psig.

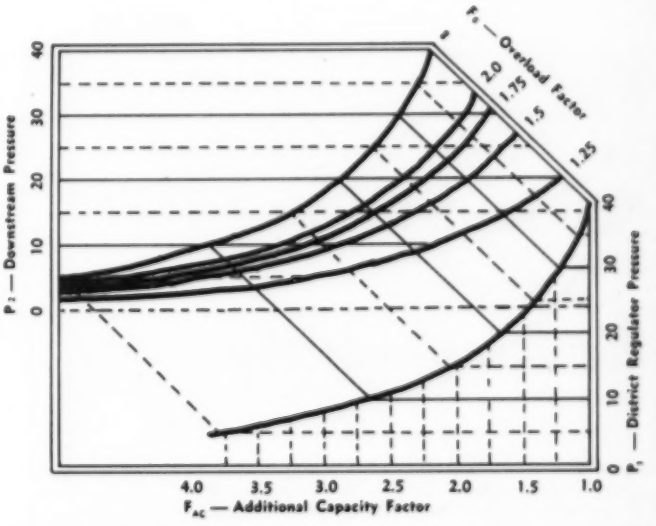


Fig. 6. Relationships of P_1, P_2, F_O, and F_{AC}, for limiting pressure of 40 psig.

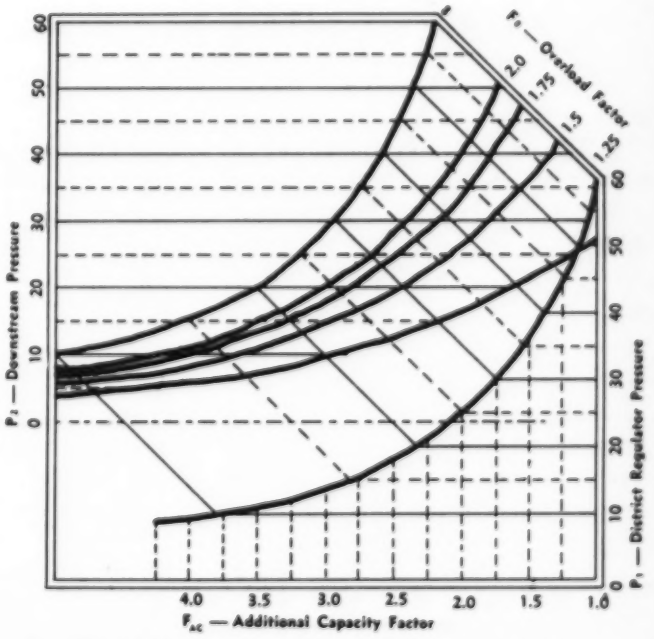
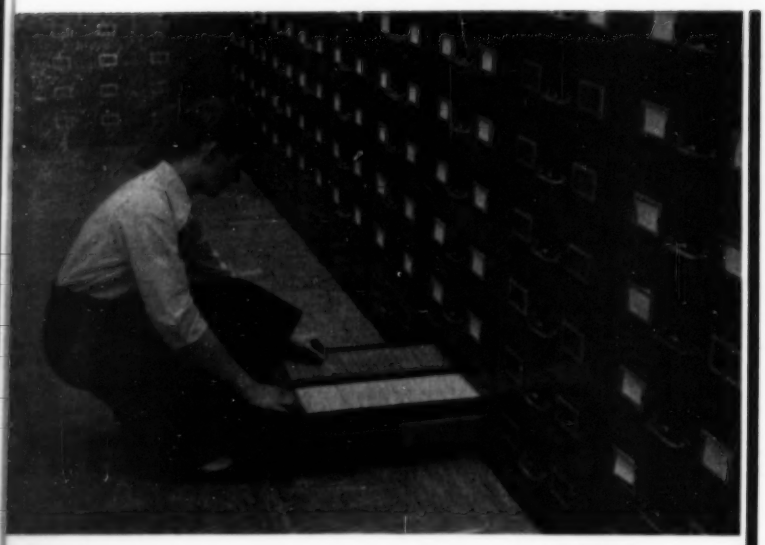


Fig. 8. Relationships of P_1, P_2, F_O, and F_{AC}, for limiting pressure of 60 psig.



BEFORE

The accounts receivable records section of Cincinnati Gas & Electric used to be equipped with 8-drawer vertical filing cabinets, which sat on the floor. Girls handling the records suffered from stiff necks and sore backs and customer billing was slow—until the company ordered 14 specially adapted cycle-billing desks. These units, originally designed for department store use, provide flexibility and convenience in filing records, and greatly facilitate handling customer accounts.

AFTER

Cycle-billing desks simplify record keeping

By JULIUS C. LUCHSINGER, Manager, Customer Activities Group
Cincinnati (Ohio) Gas & Electric Co.

ANY company serving as many as 380,000 customers regularly faces a tremendous problem in keeping its billing and record procedures from bogging down in a quagmire of mechanical detail.

Such was the case with the Cincinnati Gas & Electric Co. when it decided to change its accounts receivable filing methods in a move calculated to effect considerable savings through work simplification, and to make room for the steadily expanding account load in its customer accounting department.

This growing load is due in part to new atomic energy installations and other industrial expansions in the area serviced by the company which have both increased the volume of industrial consumption and greatly expanded the company's residential service.

In addition to its considerable growth in recent years, gas consumption in the area, because of its nature, may be expected to rise still more in the future.

For this reason, it recently became imperative that we revaluate our system of handling accounts receivable to determine whether it was still adequate to handle present workload and to absorb future increases.

The method used at the time, which involved the use of eight-drawer vertical files for keeping accounts receivable records, did not offer sufficient expansion on an economical basis.

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First of all, the files were difficult to use in a situation that called for such a heavy volume of reference. The girls in our customer accounting department often had trouble working in the next-to-top drawer (and the top drawer was never used), nor was the bottom one used for files; even the two above it required tiresome stooping.

As the size of these accounts receivable files increased, this problem became more pressing day by day. Another obstacle that was growing more acute was the fact that when one girl was referring to any part of the files in a cabinet, it was virtually impossible for anyone to use other drawers in that cabinet, or even in an adjacent one.

To solve this problem we are using 14 specially adapted cycle-billing desks. These desks were designed originally as a convenient means of housing accounts receivable records for department stores, oil companies, and other organizations.

In their normal application, however, these desks are intended to hold vertical Kolect-A-Matic files for storage of charge tickets. In a department store this type of reference is necessary because there is filing to be done each time a customer makes a purchase.

In utility billing at Cincinnati Gas & Electric, however, we are standardized on punched-card methods in customer accounting. Our need, then, was for a means of combining the working convenience of the cycle-billing desk with files to accommodate our punched-card accounts receivable. Remington Rand met this need by building six-drawer 12-tray units for punched cards into its conventional, insulated cycle-billing desk. This gave us the working convenience we were after, while retaining the fire protection, which is a necessity for these vital records.

A work station combining two of these units, with a center-writing desk, includes all accounts receivable records for three of the 21 districts into which our service area is divided.

The districts included in each work station are numbered seven apart, so that one unit includes Districts 1, 8, and 15; the next, 2, 9, and 16, and so on. Each of these stations is controlled by one girl, so far as accounts receivable records are concerned. Actually the accounts receivable operation is one of three parts of each work station, the others being customer contact and handling of work orders. Three girls handling these three aspects of our service for the three districts in question occupy each work station, including the cycle-billing desks, the writing area between them, and adjacent desks for the contact and order handlers.

We now handle between 15,000 and 20,000 individual bills on this basis in the course of each working day, and, as stated previously, the volume is increasing steadily.

When the customer's payment is received, the bill stub is sent to our customer accounting department, where all of these stubs are segregated according to district number. Then the girl handling each district pulls the cards from the insulated accounts receivable file and posts the payments.

After a daily ledger of receipts has been balanced, the cards are then placed in a non-insulated vertical file. The insulation against fire is obviously far less important for these records than for the accounts receivable file, which represents many thousands of dollars due the company.

Installation of this new accounts receivable filing system has resulted in six principal advantages for our company:

(1) A saving in man-hours devoted to handling these files.

(2) Room for expansion of our workload without substantially increasing either equipment or labor-time devoted to it.

(3) Distinctly improved employee relations—the new equipment is much easier to handle and much less tiring to the clerks.

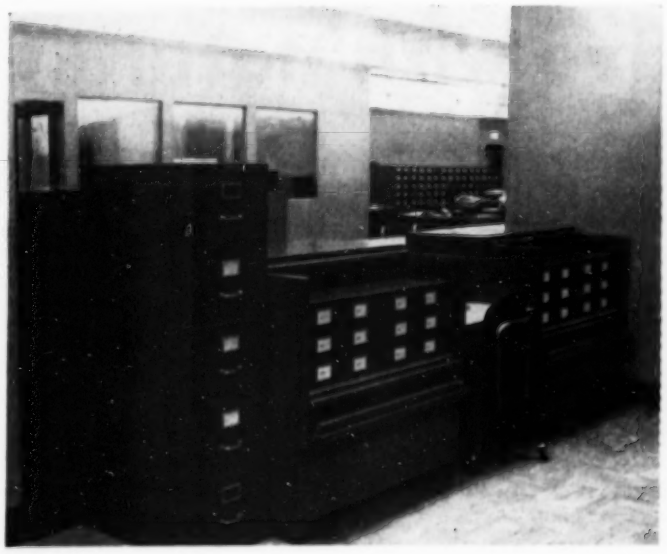
(4) A definite improvement in efficiency, reducing possibility of errors because the individual work stations help fix employee responsibility.

(5) Much quicker reference to account cards when necessary, since all cards for a given district are filed together and are not likely to be obstructed when needed.

(6) Better customer relations because of speed in answering customer's bill inquiries.

Of the benefits we have gained in setting up this new system, we believe by far the most important is its flexibility and the ease with which we shall be able to accommodate substantial increases in customer billing.

With a company growing as rapidly as we have been and expect to in the near future, it is important for us to know that we can comfortably move ahead with the growth of the community and adapt our services to fit the need as it arises. We feel our new cycle-billing desk units have definitely provided this kind of flexibility in handling our accounts receivable. ■



Work station designed for handling accounts receivable consists of two cycle-billing desks with a writing desk between.

File of meter books adjacent to her station permits clerk to reach them quickly for completion of bills.

"Oil gas made from heavy oil is definitely competing with natural gas for supplying the heating load."

This conclusion of the author's is supported by an economic study of today's natural gas pricing situation, unfolded in this adaptation of a paper presented before the Southern Gas Association convention in New Orleans May 16-18.

Readers of GAS will recall the two-part article by Hall Henry, vice president of NEGEA Service Corp., Cambridge, Mass., in the March and April issues, wherein the author presented some interesting figures on the economics of the natural gas-v.-manufactured gas situation. Mr. Harrison's remarks further develop the theme, along different lines.

Space considerations force the deletions of a lengthy description of some of the modern methods of making high-Btu oil gas.

By A. D. HARRISON
Assistant Vice President
Brooklyn Union Gas Co.

Is oil gas competitive with natural?

PRACTICAL experience in the production of oil gas by the Hall process has shown that oil gas can be produced at a reasonable cost if a suitable feedstock is used. In our own company, we produced approximately 800 MMcf of oil gas during the winter 1953-54 and over 700 MMcf of oil gas during the winter 1954-55, most of which was made by the Hall process. As a result, we were able to get some reasonably reliable figures on oil requirements and tar produced.

The feedstock used was a reduced crude oil obtained from Venezuela. A typical analysis shows 17.8° API, 1.88% sulfur and 8% Conradson carbon. This oil can be obtained in New York at a slight premium over the price of Bunker "C" oil.

The cost of making an oil gas is affected quite markedly by the value that can be obtained from the by-products. Large quantities of tar are produced together with substantial volumes of light oil. The tar is used primarily as a road surfacing material and it is customary to dispose of it to tar processors who blend it to meet specifications. The light oil is valued primarily for its content of benzol, toluol and xylol. However, at the present time, it would not be economical for a gas utility to process its light oil production in order to sell pure products. There is a very large market for these three products in the chemical industry, but when selling the crude oil it is necessary to sell it to one of the processing companies who will produce pure products from the crude light oil. This limits the market.

For comparative purposes a reasonable price for tar would be 9 cents per gallon, and for the light oil 15 cents per gallon. On the same basis, a reasonable cost for the reduced crude oil would be $2.40 per barrel. Using these figures, net oil cost for making 1040 Btu oil gas on the Hall process would be as shown in *Table 1*.

To this must be added steam, labor, and maintenance and miscellaneous costs. These items vary according to the design of the plant and the particular type of operation that will be encountered. For steady operation it is easy to calculate the payroll cost of a force of men to operate a given number of oil gas sets, but where a plant is used for peak shaving, the type of operation becomes one where some days the men are on duty but there is no call to make gas, and other days the operators are working double shifts.

To a lesser extent the same reasoning applies to the cost of steam. For steady operation, it is easy to determine the steam consumption for a particular plant, but for peak shaving operations large additional quantities of steam are used for keeping the plant warm, starting up equipment, and operating equipment on a standby basis. From 100 to 150 lb per Mcf would be a reasonable figure.

In many cases it is necessary to maintain oil gas plants in a standby condition for use in case of interruption or curtailment in the natural gas supply. This is ordinarily the case where an insufficient network of pipelines supply a particular area. In cases where it is necessary to maintain a plant on a standby basis, the additional labor and steam for making oil gas are merely the incremental additional costs that are incurred over and above the standby cost.

It is quite obvious that with a net oil cost of from 30 cents to 35 cents per Mcf, peak shaving with oil gas can be accomplished at a reasonable cost. This cost, of course, must be contrasted with the cost of purchasing natural gas when

TABLE 1. NET OIL COST FOR MAKING 1040 BTU OIL GAS

Heat oil — 1.46 gal. at $2.40 per bbl	8.3 cents per Mcf
Make oil — 12.15 gal. at $2.40 per bbl	69.4 cents per Mcf
Total	77.7 cents per Mcf
3.56 gal. of tar at 9 cents per gal	32.0 cents per Mcf
0.83 gal. of light oil at 15 cents per gal	12.5 cents per Mcf
Net oil cost	33.2 cents per Mcf

Oil gas vs. Natural... The load factor for all increases in gas sales is 25%

such natural gas is available. There is a considerable spread in the cost of natural gas in different parts of the country, but for comparative purposes *Fig. 1* shows the cost of natural gas in New York City. This was the cost last January, but the rates have increased twice since that time. You will note that whereas the cost is 32 cents per Mcf on a 100% load factor, the cost increases quite rapidly as the load factor decreases. The break in the curve is due to the operation of the 65% take-or-pay-for-provision of the rate schedule. In other words, there is a minimum annual bill based upon purchasing 65% of the maximum quantity of gas contracted for. This is equivalent to 238 days use of the maximum demand. Incidentally, many other rates are much more burdensome, requiring minimum monthly bills of 66⅔% of the maximum.

The important point to keep in mind is the fact that the major market to be served is the domestic househeating market. In New York this has a load factor of about 21%, but allowing for other increases in load, I consider it fair to assume a 25% load factor for all increases in gas sales. This corresponds to approximately 90 days' use of the maximum demand per annum, and we find the cost per Mcf for purchasing firm gas to be $1 per Mcf (*Fig. 1*).

Of course, no one is buying natural gas at 25% load factor—at least not in New York. However, additional gas purchased to supply load increases must be at 25% load factor unless some form of peak shaving is used. For example, assume a utility purchases 10 MMcf contract demand to supply added load having a maximum day of 10 MMcf. In this case the load factor of the additional natural gas purchase is 25%, even though the over-all purchase of natural gas by this hypothetical utility has a high load factor. Since the minimum take-or-pay-for provision is satisfied by existing load, we can find the cost of this additional gas by ignoring the minimum take or pay for. This is done by the dotted curve, which shows the incremental cost of 25% load factor natural gas to be 62 cents per Mcf.

In New York City at the present time, storage service is available from the Oakford storage pool near Pittsburgh. This is based upon a maximum of 90 days use of the maximum demand, and the cost of the gas, including purchase of the gas at the commodity price and the handling and storage charges, was as shown on *Fig. 1*. With 100% use of the storage service, the cost per Mcf was about 60 cents.

Last January there was a write-up in the New York *Herald Tribune* by a very eminent natural gas producer who stated that "the producer receives an average of about 12% of the household consumer's gas bill, and in New York City his share is far less, something on the order of 4 to 5%." Statements like this are misleading to say the least, because the producer is supplying only a portion of a 25% load factor business. The utility must either sell the other 75% at less than cost, or use expensive peak shaving methods.

The New York City householder who heats his house with gas is demanding service at 25% load factor for his heating gas. The gas producer, even if he were willing to sell his gas at a 25% load factor, would find the transportation cost to New York prohibitive. Economic operation of a long pipeline system requires operation at or near 100% load factor.

If any substantial proportion of the customers of a long pipeline such as the Transco pipeline here in New York were to take gas at a 60 or 70% load factor, the pipeline's unit cost would increase, and they would be forced to pay increased rates. After all, these rates do not even pretend to make a cost allocation between demand and commodity. For this reason, a chart based upon the filed rate schedules as I show here does not give the real story.

In New York the valley gas during the summer months is used on an interruptible basis for steam generation for electric power plants and other industrial uses. If we start with the basis that the pipeline operation must be kept at 100% load factor in order to keep down the pipeline transportation cost, we can then determine the cost of gas for the firm load.

Returning again to the domestic house heating customer, which is the largest load and the prime reason for delivering natural gas to northern markets, we find that the load factor for this business is 25% as previously remarked. Since the pipeline operates at 100% load factor, the other 75% of the natural gas must be sold for steam generation at prices competitive with coal and No. 6 fuel oil. With this in mind, we have constructed a chart *(Fig. 2)* showing the effect of interruptible revenue on the cost of gas for the heating load. This chart is based upon the February bonded rates of Transcontinental Gas Pipe Line Corp. and Tennessee Gas Transmission Corp. Transco is our major supplier in New York City. Tennessee has a certificate to commence supplies this fall. Texas Eastern Transmission Corp. supplies a small load on Staten Island, and its rate would fall between the Transco and Tennessee rates. Transco's rates have gone up again since February, so that this chart, while more up to date than the previous chart, still has not caught up with the rising price of natural gas.

This chart assumes that the pipeline operates at 100% load factor, and shows the cost of gas for supplying the heating load when the valley gas is sold at varying rates. For example, the 100% load factor rate for Transco was 34.1 cent. Therefore, if interruptible gas could be sold for 34.1 cents, then the cost of gas for the house heating customer is also 34.1 cents. However, if interruptible gas can only be sold at 30 cents per Mcf, the cost of firm gas for the heating customer must be sufficient to make up the deficiency. In this case the chart shows the cost from Transco would be 48 cents per Mcf, and from Tennessee 63 cents per Mcf.

In New York at the present time, the cost of coal is equivalent to natural gas at 34 cents or 35 cents per Mcf. In the case of the gas company wishing to sell valley gas on an interruptible basis, provision must also be made for revenue tax, which in our own case will amount to about 1 cent per Mcf, and also carrying charges and upkeep on the facilities required for delivery of natural gas to the customer. On the other hand the customer must have some inducement in the form of a profit after he has paid the carrying charges and upkeep on the equipment he requires for burning the gas under his boilers.

In the case of my own company, the bulk of our sales of interruptible gas net us approximately 27 cents per Mcf after revenue tax. We do have some industrial interruptible customers from whom we get a higher rate, but these are limited in the quantity of gas they

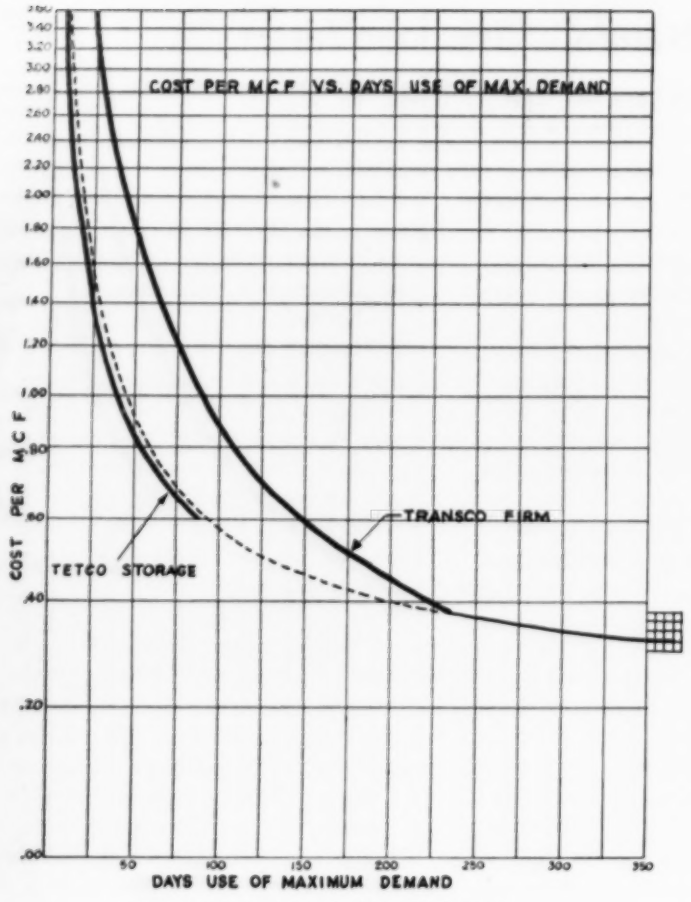


Fig. 1. Cost of gas in New York City.

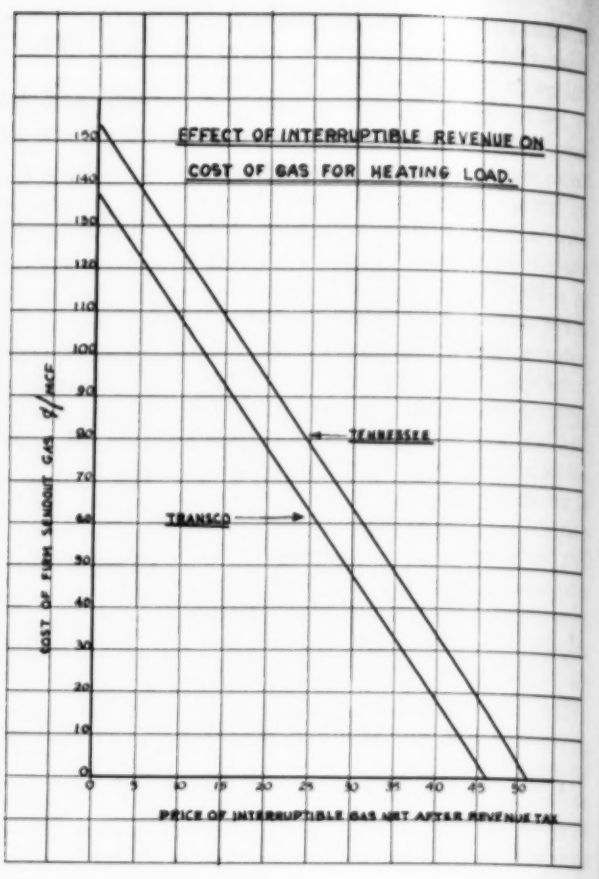

EFFECT OF INTERRUPTIBLE REVENUE ON
COST OF GAS FOR HEATING LOAD.
COST OF FIRM SENDOUT GAS ¢/MCF
TENNESSEE
TRANSCO
PRICE OF INTERRUPTIBLE GAS NET AFTER REVENUE TAX

Fig. 2. Effect of interruptible revenue on cost of gas for the heating load.

can utilize. In working out the economics of the purchase of additional supplies of natural gas, the revenue from these customers would not be significant. What is significant, however, is that the price obtainable from interruptible customers is independent of the cost of the natural gas. It is determined solely by the cost of competing fuels.

Taking this figure of 27 cents per Mcf and looking up on the chart to find out the cost of the gas for firm sendout, we find that from Transco the natural gas cost for firm sendout is 56 cents per Mcf based on last February's rates. Present rates have increased this to about 60 cents per Mcf. The corresponding figure from Tennessee would be 72 cents per Mcf. What this means is that despite 100% load factor natural gas prices of 34.1 cents for Transco, and 38.2 cents for Tennessee, the cost of this gas at a 25 cents load factor (which is what the customer demands) is 60 cents from Transco, and 72 cents from Tennessee. And this is without investment in facilities to deliver the gas to the customer.

I previously described a net oil cost for oil gas of 33.2 cents per Mcf. In cases where plants are already in existence and must be maintained for standby purposes in case of interruptions of natural gas supply, it is quite evident that there is enough margin between this figure and the natural gas costs averaging between 60 cents and 70 cents to take care of steam and labor and maintenance and other incidental expenses. Furthermore, at the rate at which the price of natural gas in the New York area has been increasing over the past couple of years, it may be that the spread will be sufficient to pay for the construction of additional gas sets, that is, if we are not priced out of the househeating market.

Of course, one answer that can be worked out in certain situations is the use of underground storage. *Fig. 1* showed the cost under filed tariffs of the use by New York and Philadelphia utilities of the Oakford storage near Pittsburgh. Of course, this storage is in excess of 300 miles away but, nevertheless, the cost is so high as to make it of very doubtful attractiveness. In adjusting this chart for up-to-date natural gas rates, we find that on a 90-day use, the gas from Oakford storage would cost 63 cents per Mcf and, of course, as the day's use of the maximum demand decreases, the cost very quickly gets up to $1 per Mcf.

This is a very awkward situation. The purpose of underground storage is to improve the load factor of the firm gas purchased, thereby lowering the cost. However, from a practical standpoint, when contracting for underground storage at these rates, the operation is more likely to come out to a 50- or 60-day use of the maximum demand. The resultant cost as shown on the chart amount to 80 cents to 85 cents per Mcf. This is much higher than the cost of producing oil gas. It is, therefore, evident that underground storage, as presently available in New York, is not the answer.

The great pipeline systems have been built on the basis of 100% load factor. This has meant substantial use of valley gas for boiler fuel in many areas of the country. The increased cost of natural gas is upsetting this picture. As a result, oil gas made from heavy oil is definitely competing with natural gas for supplying the heating load. I have presented the picture in the New York area, and the same method could be used to work out the answer in other areas of the country. ■

Economic considerations of corrosion control on underground piping—Part 2

In addition to the rocky nature of the area, the soil here proved to be highly corrosive.

Rectifiers vs. galvanic anodes and other details of cathodic protection

By A. W. PEABODY, Electrical Engineer • Ebasco Services Inc., New York

WHEN planning cathodic protection for a section of pipeline or a portion of a distribution system, a question that often arises is the economic balance between the use of rectifiers and the use of galvanic anodes, which (because of their being distributed or in relatively closely spaced groups) can furnish adequate protection with less total current output. The more important factors affecting installation of galvanic anodes are soil resistivity and cost of working on the right-of-way (cost of getting to installation sites and cost of property damages) while some of the more important variables affecting rectifier installations are soil resistivity, right-of-way costs for ground bed construction, and electric power costs.

The same pipeline example can be used to check the effect of some of these factors. Consider a comparison under the following conditions: pipe coated with a 50,000 ohm per square foot nominal coating, galvanic anodes to protect the 100 miles of line with 15 amps and rectifiers with 16 amps, five rectifier installations (with 0.8 ohm ground beds) and 20 galvanic anode groups to be sufficient, 1000 ohm-cm soil available for installation of rectifier ground beds and galvanic anode groups, cost of right-of-way and crop damages established at $1.25 per rod, and cost of electrical energy taken as 5.5 cents per kwh, average.

Under the conditions as outlined above, the cost comparisons show that the total investment required for the installation of the rectifier system would be 44% of the investment required for galvanic anodes. Although the first cost of the rectifier system is less than half that of the galvanic anode system, the annual costs are such that those for the rectifier system are, in this case, about 6% higher than those for the galvanic anode system. *Table 1* (July, pp. 46-47) shows that under the conditions assumed for this sample system, bare pipe and pipe having coating resistances of 10,000 and 25,000 ohms per square foot can be more economically protected with rectifiers while pipe having coatings of 50,000 or more ohms per square foot can be more economically protected with magnesium anodes. Similar comparisons can be made for any specific system in order to determine where the break point between economical rectifier operation and economical use of galvanic anodes takes place.

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Cathodic protection... Longer lived materials are the best choice economically

In calculating installed costs for the rectifier protection system, the following items were included: (1) material costs and installation costs for the five rectifier installations (each of which includes a 12-volt, 10-ampere rectifier unit, four graphite anodes, 355 ft of underground insulated cable, coke breeze anode backfill, and all miscellaneous items); (2) cost of materials and installation of permanent test points at each rectifier, at midpoints between rectifiers, and at each of 25 foreign pipeline crossings; and (3) engineering costs for system design, selecting installation sites, supervising installation, and making final tests and adjustments. The annual costs for the rectifier system include: (1) fixed charges on invested capital; (2) electric power costs; (3) cost of line crew for heavy maintenance work; (4) cost of monthly check of all rectifier installations; and (5) the cost of a detailed annual survey.

The calculated installed costs for the magnesium anode protection system include the following items: (1) material costs and installation costs for the 20 anode installation (each of which includes 20 17-lb packaged magnesium anodes, 240 ft of underground insulated wire, and miscellaneous items); (2) costs for materials and installation of permanent test points at each anode group, at midpoints between groups, and at each of 25 foreign pipeline crossings; and (3) engineering costs for system design, selecting installation sites, supervising installation and making final tests and adjustments.

Rectifier systems can be and are used on pipelines having coatings with such high resistance that galvanic anode protective systems would appear to be more economical. This is often done with an eye to the future by installing a rectifier system with sufficient reserve current capacity to permit extending protection to added facilities (such as new compressor station or loop lines) without major additions to the cathodic protection installations. When using rectifiers, this additional capacity can be provided at much lower expenditure than that required to maintain the same reserve capacity with galvanic anodes. in the example quoted above, the galvanic anode installations are sufficient to provide the required 15 amps with a probable life of about 23 years. The five rectifiers furnishing 16 amps could, if required, furnish a total of 50 amps (34 amps reserve) at no increase in capital investment and still have a life expectancy equal to that of the magnesium anodes. If there were a need for only 15 amps reserve capacity, the capital investment for galvanic anodes would have to be doubled. From this it becomes apparent that the choice between rectifiers and galvanic anodes should be based on an evaluation of future plans for the pipeline system as well as on the protection problem immediately at hand.

In the preceding comparison between galvanic anodes and rectifiers, magnesium anodes were used as the current source for the galvanic anode case. Since zinc anodes are also suitable in low resistivity soil, a cost comparison between zinc and magnesium should be made for this case where anode sites were assumed to be in 1000 ohm-cm soil even though the average soil resistivity for the entire line was taken as 5000 ohm-cm.

Whereas in the rectifier-magnesium anode comparison, each of the 20 anode installations required 20 17-lb magnesium anodes, each such site would require 22 33-lb 2 in. x 5 ft cast zinc anodes to give the same current output. At current prices for materials and installation, the cost of the zinc installation would be approximately 26% greater than that of the magnesium anode installation for *equal current outputs*. On this basis, however, life expectancies of the two anode materials are such that the cost per year of life for the zinc installation is about 4% less than the cost per year of life for the magnesium installation, thus making zinc actually the more economic material in this particular example.

When making comparisons between zinc and magnesium, current prices must always be checked since there can be considerable variations in the price of the basic metals. At the present time, zinc is relatively cheap and this condition is reflected in the cost comparison. The comparison made in the preceding example included the assumption that both zinc and magnesium would protect the structure with the same amount of current. Although this can theoretically be done, the usual result in practice will show that if a zinc anode installation will furnish a protective potential of, for example, -1.0 volt at a particular site, a comparable magnesium anode installation with its higher driving potential can easily stabilize at a potential in excess of -1.0 volt— say -1.2 volts, structure to soil. If -1.0 volt protective potential is all that is needed, a maintained potential of -1.2 volt is indicative of wasted current.

Since current increase is not proportional to potential increase but is some power of the potential increase, the output of the magnesium anodes can easily be several times as much as that of the zinc even though the zinc is furnishing adequate cathodic protection; this effect is more pronounced in low resistivity soils than in high. The net result of this is that the useful life of magnesium anodes will usually be much shorter with respect to zinc life than would be expected from an example worked out on the basis of equal protective currents. This effect, when properly evaluated, can mean that zinc anodes are decidedly more economical than magnesium in some applications.

Where rectifiers or other sources of impressed current furnish the required protective current, there are a number of factors affecting the economical construction of ground beds that must be used with these current sources. Included among these factors are selection of anode material, size of electrical conductor used, physical spacing between individual anodes in the ground beds, costs for right-of-way, and costs for electric power (where rectifiers are used).

When selecting anode material, it can usually be shown that the longer lived materials are the best choice economically. An an example, compare (1) the use of a 3 in. by 5 ft graphite anode back-filled with 150 lb of coke breeze to give an effective electrode size of 6 in. by 10 ft with (2) a 10-ft length of 6-in. steel pipe such that the resistance to earth of the two types will be approximately the same.

The cost of the graphite anode and backfill material (including an allowance for transportation) will be approximately $17 while the cost of the scrap steel anode at $30 per ton (including transportation) will be approximately $2.85 for the 190-lb anode.

Installation cost for the graphite anode will be approximately $25 and that for the steel anode will be about the same (including the cost of attaching a connecting wire to the steel anode and properly insulating it).

The total cost of the graphite anode installation will then be $42 for a useful life of approximately 20 years at 2 amperes output assuming material consumption rate at 2 lb per ampere per year and end of useful life when 50% of the material has been consumed. Investment per year of life is $42/$20 or only $2.10.

The total cost of the steel anode installation will be $27.85 for a useful life of 2.4 years at 2 amperes output and a material consumption rate of 20 lb per ampere per year assuming that the useful life of the anode will be terminated when 50% of the steel has been dissolved. Investment per year of life for the steel is then $11.60 showing that it is substantially more expensive on a life basis than is the longer lived graphite, which has the higher initial cost. This would be true even if the steel anode cost absolutely nothing for material—just the cost of installing it for only a 2.4-year life would make it more expensive than the graphite anode. Maintenance costs should be about equal for the two types of anodes being compared and were, therefore, not included in the comparative costs.

The economical size of the cable used to connect the rectifier (or other source of impressed current) with the pipeline and ground bed will depend on cable costs, amount of cable required, current carried by the cable, and cost of power. At average rates for electric power, it can often be shown—particularly for larger ground beds—that, within limits, the annual value of power saved by increasing conductor size will be greater than the annual cost of increasing the conductor size. The upper limit will depend on the price schedule for conductors used, power costs in the bracket affected by changing conductor size, need for more expensive connection devices, or in some cases reaching the largest size which can conveniently be handled under field conditions.

Take, for example, a ground bed discharging 50 ampere and having 50 anodes on 20-ft centers with the nearest anode 400 ft from the pipeline being protected and assuming a cost of 1.5 cents per kwh for electricity in the bracket where power costs would be affected by changes in conductor size. Consider first a change from #2 Awg copper cable to 1/0 Awg copper cable—both having moisture resisting insulation and protective outer jacket. The effective cable resistance is that of the distance from pipeline to first ground bed anode plus 15 ft (allowance for leads to terminals of pole-mounted rectifier) plus 0.32 times the length of the ground bed—in this case, 400 + 15 + 315 or 730 ft. The figure of 0.32 times the length of ground bed proper is not uniform for all sizes of ground bed but for most usual sizes will be accurate within a few percent; the resistance of this portion of the ground bed cable multiplied by the square of the total ground bed current is approximately the same as the distributed power loss in the cable along the line of anodes.

Full wave rectified d-c from bridge-connected dry disc rectifiers—the commonest source of power for impressed current installations—contains an appreciable amount of second harmonic current, which can have an effect on power losses in ground bed cables. Although there will be variation in the amount, second harmonic current can be estimated at 20% of the d-c component. Using this, we can say that the 50-ampere d-c output of the example rectifier installation cited above has a second harmonic component of 10 amperes—the effect of which would not be noted on D'Arsonval-type instruments normally used. The effective rms current for calculation of current losses will then be approximately 51 amperes.

From the above (using 51 amps current for loss calculation purposes) the effective resistance of the #2 cable will be 0.114 ohm and the d-c power loss will be 296 watts or 423 a-c watts at 70% rectifier efficiency. The effective resistance of the 1/0 Awg cable will be 0.071 ohms and the power loss will be 185 d-c watts or 264 a-c watts. Annually, the cable losses will cost $56 and $35 respectively with a saving of $21 by using the larger cable. Purchase costs for 1395 ft of cable will approximate $332 for the #2 Awg cable and $480 for the 1/0 Awg cable.* At 13% fixed charges for 20-year life, the difference between these two cable costs represents an annual premium of $19 for the larger cable, indicating that it can be economically used since the saving in power losses will be greater than the annual cost of additional capital required to procure it. If the unit power cost were greater, the economic advantage of the larger cable would be greater but for lower power costs, the smaller cable could show the lowest annual cost.

If the same comparison as above is made between size 1/0 Awg cable and 2/0 Awg cable, power losses will be 185 d-c watts or 264 a-c watts in the 1/0 Awg cable and 151 d-c watts or 216 a-c watts in the 2/0 Awg cable with annual costs of $35 and $28. Purchase costs for the cable will approximate $480 for the 1/0 Awg cable and $590 for the 2/0 Awg cable. At 13% fixed charges for 20-year life the annual value of additional capital required for the larger cable will be $14, which is greater than the $7 annual savings in power losses making the 2/0 cable uneconomical. For any particular proposed project, comparisons should be made using current prices for the type of cable to be used and using applicable power rate schedules.*

The preceding wire-size discussion applied primarily to rectifier ground bed installations but holds true for galvanic anode installations after establishing a power rate. If, for example, the installed cost of a 17-lb magnesium anode is $16 in a particular system and if a useful life of 20 years is assumed at an average current output of 40 milliamperes, the cost of power per kilowatt-hour will be the annual cost of the investment (13% fixed charges) divided by the annual power output—in this case (assuming a 0.65 volt driving potential) it might be $(\$16.00 \times .13) \div \frac{(.04 \text{ amp} \times .65 \text{ volt} \times 8760 \text{ hr})}{1000}$ or $9.12 per kilowatt hour. Considering a single-anode installation having 40 milliamp output and requiring 20 ft of wire for the pipe-to-anode connection, a comparison of No. 14 and No. 12 wire will show a power consumption of

*A further discussion of this subject is contained in recent papers by Wainwright[3] and Marshall[4], which treat this particular phase of cathodic protection economics in more detail.

TABLE 2. EFFECT OF ANODE SPACING ON NUMBER OF ANODES

Spacing	10 ft	15 ft	20 ft	25 ft	30 ft	35 ft	40 ft
Number of anodes	22	17	15	14	13	13	12
Length of ground bed	210 ft	240 ft	280 ft	325 ft	360 ft	420 ft	440 ft

Cathodic protection... Spacing between anodes affects economics of ground bed construction

.000083 watt in the 0.052 ohm resistance of the No. 14 wire and .000053 watt in the 0.003 ohm No. 12 wire. Cost of the No. 12 wire over that of the No. 14 wire would be approxiately 15 cents with an annual value of 2 cents (13% fixed charges on 20-year life). Power saving by using the No. 12 wire would be 0.00003 watts x 8.76 or 0.0000263 kwh annually worth 0.24 cents according to power value established for this example. This indicates that connecting wires in such a single-anode application need only be large enough to meet mechanical strength requirements. For multiple anode installations, conductor size costs can be analyzed in a similar manner to that used for rectifier ground bed cable in preceding paragraphs.

Spacing between individual anodes in a ground bed has a direct bearing on the resistance to earth of the complete bed and likewise affects the economics of ground bed construction. Increasing anode spacing reduces the ground bed resistance by reducing mutual reaction between anodes—but each additional increment of spacing increase reduces ground bed resistance less than the last while cost of making the increase remains approximately the same. This indicates the existence of a definite spacing for any set of conditions beyond which it would not be economical to go. To illustrate this, an example can be considered where a 0.5 ohm ground bed is desired in 2200 ohm-cm soil using anodes of 6 in. by 10 ft in effective size (graphite anodes backfilled with coke breeze) and No. 1/0 copper cable with the ground bed 300 ft from the structure being protected. Pertinent cost figures include $40 per installed anode, $0.85 per foot of installed cable, and $1.25 per rod for construction right-of-way and damage.

In 2200 ohm-cm soil as assumed for the example, anode spacing will affect the number of anodes required for a 0.5 ohm ground bed (including ground bed cable) as shown in *Table 2*.

As the spacing between anodes increases, the cost of additional cable and right-of-way will become greater than savings in number of anodes installed. This is illustrated by *Table 3*.

The figures in *Table 3* show that, in this case, spacing in the range from 20 to 30 are more economical than either longer or shorter spacings. *Fig. 1* demonstrates the same effect by comparing total ground bed installed cost with anode spacing and again shows that the most economical range is from 20- to 30-ft anode spacing.

Costs used in the example were based on recent figures but would, of course, have to be established for his own system by any operator desiring to determine an economical spacing for a proposed ground bed installation project. In the preceding comparison, for instance, anode installation prices were based on 12-ft deep vertical anode holes but if 20-ft deep holes had been required (to reach low resistivity soil) the increase in contract installation price would have been sufficient to make greater anode spacings economical for the example cited.

Where galvanic anodes are to be used in groups, the economical anode spacing for any proposed project can be determined in a similar manner to that used for rectifier ground beds.

Costs for right-of-way for ground bed construction represent a highly variable segment of the economic picture since there is no possibility of complete control over this item. What might be considered normal right-of-way costs vary widely from company to company and within companies covering large areas of operation. In general, right-of-way cost will increase as the value of the land crossed increases but the company having excellent public relations may obtain right-of-way at a lower average rate, through a given area, than will a company toward which there is any appreciable degree of public resentment. Because of the wide variations possible, no rule for a fair right-of-way cost can be established but a figure of $1 per rod, plus crop damages, for the total length of ground bed and cables run from ground bed to pipeline can be used as a starting point. Some companies will be able to do much better than this while others may have to pay several times this rate.

TABLE 3. COST OF ADDITIONAL CABLE AND RIGHT-OF-WAY

Spacing Increase	Reduction in Number of Anodes		Increase in Bed Length		Change in Ground Bed Cost by Increasing Spacing	
	Number	Cost	Feet	Cost	Decrease	Increase
10 ft to 15 ft.....	5	$200	30	$28	$172	—
15 ft to 20 ft.....	2	80	40	37	43	—
20 ft to 25 ft.....	1	40	45	42	—	$ 2
25 ft to 30 ft.....	1	40	35	32	8	—
30 ft to 35 ft.....	0	—	60	56	—	56
35 ft to 40 ft.....	1	40	20	18	22	—

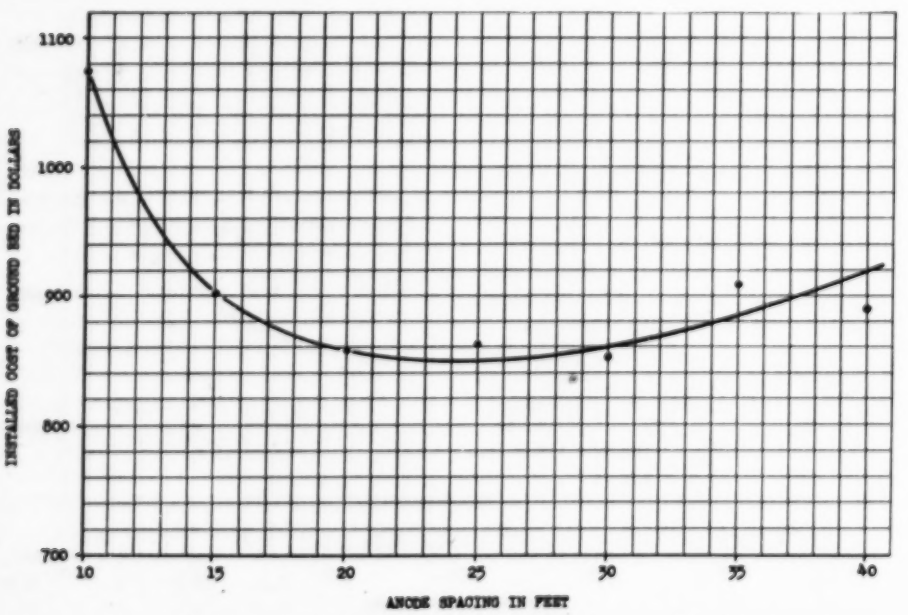

Fig. 1. Economical anode spacing for rectifier ground bed.

High average cost for right-of-way can affect the economical spacing of anodes in ground bed construction by tending to reduce the economical spacing. In the event that a good ground bed site is found but the land owner demands more than the normal fee for right-of-way, relocating the ground bed site will be profitable only if that part of the land owner's demand over and above the usual settlement figure is greater than the cost of a field engineering crew to relocate the ground bed. If, however, ground bed sites are sufficiently close together that there will be possibility of communication between adjacent land owners on which right-of-way is desired, paying more than the normal rate to one owner may create a demand for excessive settlements on the part of other owners thus making it more economical to move the ground bed site than to pay higher than the established rate. Although the preceding discussion assumes that there is some flexibility in ground bed location, cases may be encountered in which there is only one suitable location for a proposed unit. If right-of-way difficulties are encountered in such cases, it may be possible to successfully enter condemnation proceedings to obtain right-of-way if it can be established in court that the site selected for the ground bed is the only practical one for the purpose desired.

In the case of rectifiers, there is a question of economical ground bed resistance as affected by power costs. The many variables necessitate a specific study for any proposed installation where applicable electric rate schedules are known, where material costs are known, and where installation costs and average right-of-way costs are known with a reasonable degree of accuracy. To illustrate, graphically, the results of such a study, costs were calculated for ground beds of various resistance using the pertinent information in the accompanying box.

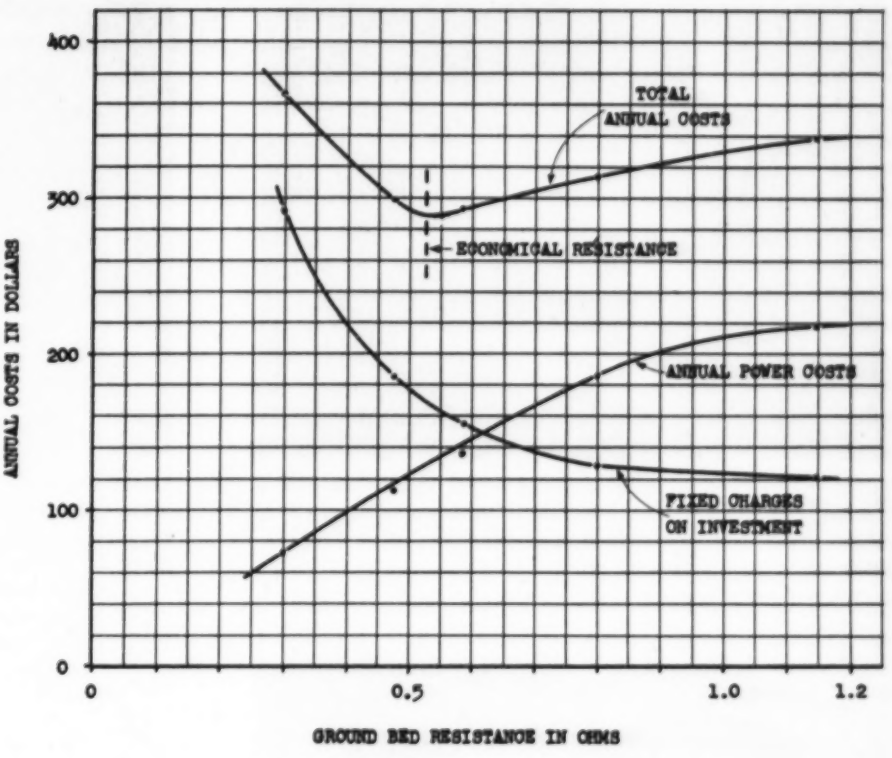

Fig. 2. Economical ground bed resistance.

Cost calculation for ground beds of various resistance

(1) *Cathodic protection requirements:* 20-amperes d-c output from a rectifier and ground bed installed in soil of 2000 ohm-cm average resistivity. Rectifier assumed to be 70% efficient. Ground bed to be 300 ft from line to be protected.

(2) *Electric power rate:*

First 50 kwh	5.5 cents/kwh
Next 300 kwh	4.5 cents/kwh
Next 650 kwh	1.5 cents/kwh
Above 1000 kwh	1.0 cents/kwh

(3) *Rectifier prices:*

8-volt, 20 ampere rated d-c output	$172.00
18-volt, 20 ampere rated d-c output	221.00
40-volt, 20 ampere rated d-c output	335.00

(4) *Installed cost* of No. 1/0 ground bed cable: $0.85 per ft. (Total cost covering cost of making pipeline connection.)

(5) *Installed cost* of 3 in. by 5 ft graphite anode in 12 ft by 8 in. auger hole and backfilled with approximately 200 lb of coal coke breeze: $40.

(6) *Cost of right-of-way and damage:* $1.25 per rod.

(7) *Cost of* setting rectifier pole, cost of pole, and cost of installing rectifier and all associated equipment and fittings: $110.

(8) *Fixed charges* on capital investment based on 12.5% for an average installation life of 35 years.

To obtain a sufficient range of values, the costs were calculated for ground beds containing 5, 8, 12, 16 and 32 anodes, which resulted in circuit resistances of 1.148, 0.8, 0.585, 0.475, and 0.298 respectively. The results as shown plotted on *Fig 2* clearly indicate that the economical ground bed resistance for this example is approximately 0.5 ohm and that higher or lower resistance cause substantial increases in over-all annual costs. In making comparisons of this type, it will be noted that higher power costs will tend to result in lower economic ground bed resistance and that lower installed costs on the ground beds will also result in economical ground beds of lower resistance.

In conclusion, the reader is again cautioned that although the cost comparisons covered herein are presented to show probable trends, none of the results should be taken as general guides. The corrosion engineer concerned with economical corrosion control on a specific system should make his own economic comparisons based on the unit costs and financial charges which are directly applicable to that system. ■

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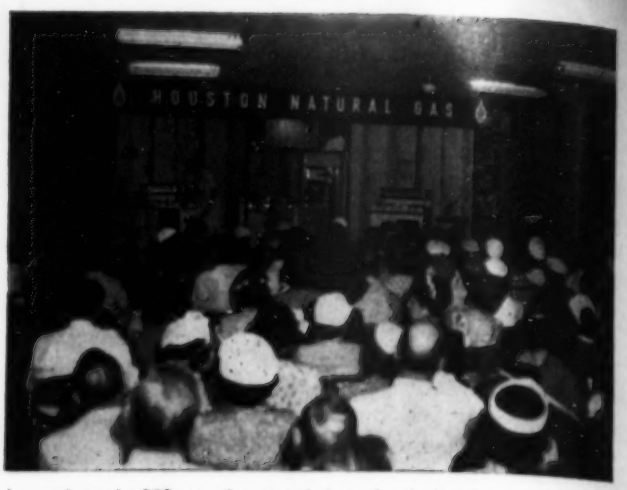
1. A. W. Peabody and C. L. Woody, *Corrosion*, 5, No. 11, 369-377 (1949) November.
2. Rogers, Davis, Sheppard, Sharpe, Allen, Bond, and Miller, *Corrosion*, 7, No. 7, 245-251 (1951) July.
3. R. M. Wainwright, *Corrosion*, 9, No. 9, 325-328 (1953) September.
4. M. E. Parker, *Oil and Gas Journal*, Oct. 19, 1953, "How to Select Size of Rectifier Cable."

Island sink at the left distinguishes this kitchen at the Cavalcade of Kitchens. The kitchen has cabinets of Honduras mahogany set off by white plastic brick, and yellow countertops and yellow Servel refrigerator.



Approximately 350 people attended each of the three performances of the Cook-O-Rama during the Cavalcade of Kitchens. Here Home Economist Norma Braly demonstrates the ease of using a 1955 Caloric range.

This black, charcoal, white, and shocking pink kitchen was one of the biggest attractions at the show. The built-in oven and burners by Western-Holly were in patent-leather black and chrome. Snack bar backs up the island range-top counter.

Jimmy McClain (left), the original "Dr. I.Q." of radio fame, is discussing with Rolland Storey, HNG sales promotion manager, the Cook-O-Rama show, one of the highlights of the Cavalcade.

Houston's kitchen show highlights modern appliances

HOUSTON (Texas) Natural Gas System believes it achieved the underlying objectives of its recent kitchen show—to place modern gas appliances in strikingly modern and handsome surroundings and to solidify built-in equipment as a fundamental of good kitchen planning—when the four-day Cavalcade of Kitchens came to a close with a total attendance of 12,134. Just what brought out the crowd is an issue Houston hopes a forthcoming market survey will resolve, but there were plenty of inducements.

Top billing at the Cavalcade went to 10 full-size "dream kitchens," complete down to the last trivet. Baiting the promotional hook further, Houston gave away a pair of kitchens. One was a domestic kitchen valued $2500 and the other was a stainless steel commercial type to be donated to a charitable, civic, or church institution in the name of the holder of the winning card.

Of all the crowd-gathering tactics, however, Houston Natural is proudest of its unusual advance sale plan whereby the sales promotion staff contacted every church, civic organization, and charitable institution in Houston with a money-making plan for the organization: Buy a block of 100 tickets for $25, sell them for 50 cents each. For every person who turned up at the show holding one of the tickets, the company returned the quarter that the ticket cost originally. More than 10,000 tickets were distributed to various groups under the plan. Of these, some 4000 were presented by show visitors.

All 10 kitchens included gas ranges, eight of them built in. Seven kitchens had adjacent laundry areas with gas clothes dryers or gas Duomatics. Every kitchen was equipped with a gas refrigerator. Two displays included gas water heaters, and one featured a gas disposer. ■

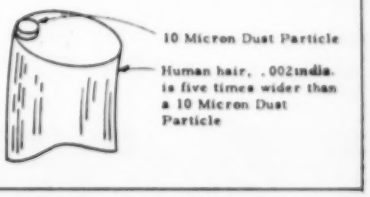
Customer service dust traps...

why use them?

By C. W. STEWART, Chief Engineer • Sprague Meter Co., Bridgeport, Conn.

Dust found in distribution systems contains a fairly standard analysis (see Fig. 1 at right), and has a granular consistency similar to dry Portland cement. The illustration shows the comparative width of a human hair. It is not only the damaging effect that foreign matter has on regulators and meter accuracy, but also its ill effects on the quality of service, which are alleviated by the use of dust filters.

Silica Approx.	2.1%
Iron Oxide Approx.	97.4%
Sulphate	0.2%
Indeterminate	0.3%
Total	100.0%



GAS exclusive

TODAY, with the almost unbelievable new developments for modern living being offered the public, plus improvements of all the existing devices available, the gas industry is facing a period of competition that in retrospect of what has gone before will seem like child's play. While there are many facets and forms that this competition and methods of combating it will take, there is one phase of the gas industry that, unless vigorously maintained, can bring to naught all other efforts. That one important thing is *clean gas.*

Gas companies have strived for years to improve the quality of their product and have, incidentally, done a very good job. For years the gas sold to the public was predominantly manufactured, and because of its moisture content had a tendency to lay any dust or dirt in mains or services. The last decade has seen an amazing reversal. Today, we find natural gas the predominant gas being served the public. This change has brought benefits such as cheaper gas in most instances, and because of its higher Btu value, it has almost doubled the capacities of existing main systems. Along with these advantages have come some problems, one of which is the drying out of mains and services with the resultant trouble with dust and dirt.

Dust formation is a continuous process in systems handling hydrated gas containing oxygen and sulfur-bearing impurities. In old systems that have been converted to dehydrated natural gas, the dust problem is even more extensive.

Dust found in distribution systems contains a fairly standard analysis (see *Fig. 1*) and has a granular consistency similar to dry Portland cement. The granular size varies from about 5 microns upwards.

If dust larger than approximately 15 microns is screened out at the meter loop, remaining dust should not reach or affect a properly designed pilot-light orifice. To place these measurements on a practical basis, *Fig. 1* shows the comparative width of a human hair, which is five times the width of a 10 micron dust particle.

Simple chemistry tells us that this analysis shows 2.1% sand and 97.4% rust particles, which, of course, are fine particles of decomposed pipe, the result of abrasion by high velocities of other dust particles or decomposition by oxygen and sulfur-bearing impurities.

Another source of dust or dirt is the result of what might be called the "H" or human factor. No matter to what lengths one goes to insure installing clean pipe, the ideal installation never seems to be achieved. Dirt inadvertently gets into the mains because of careless handling by workmen, or children throwing rocks and dirt into the open ends of uncompleted piping, their handiwork unnoticed before the installation is completed. Another constant source of foreign material getting into the main system is iron chips and shavings from tapping services and other connections.

It is not only the damaging effects that all this foreign matter in the mains and services has upon regulators and meter accuracy, but also its effects on the quality of customer's service. The result is costly to the gas company in service calls, inconvenience to customers, and damage to public relations. All this adds up to a vulnerable point that can and will be attacked by competitors. Unless gas utilities will recognize the seriousness of this growing problem they are faced not only with the possible loss of consumers, but a continually rising cost of service calls and the loss (important, though of indeterminate value) of customer relations.

Dust traps...House-type filters should stop dust down to 10 microns

There are six main places where dust and foreign matter should be removed, namely:

1. The wellhead
2. Compressor stations
3. City gates
4. District regulator stations
5. The consumer's meter or regulator and meter sets
6. The pilots and controls of individual appliances

At each of these locations we are concerned with removing particle sizes of different magnitude. Typical installations of the type of filter to be used at the inlet to the house regulator on intermediate pressure meter sets discussed here, are shown in *Figs. 2* and *3*.

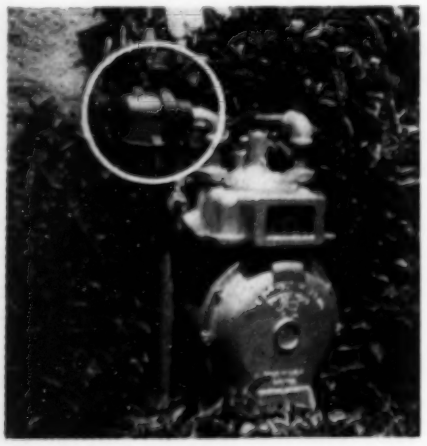


Fig. 2 (left) is a 90° trap and Fig. 3 (right) is a 180° trap. Shown are typical installations of the type of filter to be used at the inlet to the house regulator on intermediate pressure meter sets.

On the basis of empirical data, house type filter should be capable of stopping dust particles down to 10 microns in order to be on the safe side.

Sprague Meter Co. has for some time been aware of this growing problem, and after many years of research and development has produced an all-metal dust trap to be installed on the inlet to the customers' regulator on intermediate and high pressure distribution systems. It is a dust trap that is efficient, economical and has three distinct principles for dust removal. These are: velocity, centrifugal force and filtering. The porous metal element has carefully controlled porosity factors designed to remove down to 10 micron dust particles. The centrifugal force action at higher than normal velocities tends to throw the heavier particles to the wall of the bowl where they drop out of the gas stream. This feature has the effect of less work and consequently a longer life of the element as compared to a filter not using centrifugal force as part of its method of dust removal. Another feature is that the element can be readily inspected or removed without disturbing the piping and can be cleaned and reused.

At this point one might say "Okay we are, or we know as time goes on, we will be faced with this problem, but tell me what can we do to mitigate and combat it? Can we justify the expense?" The answer is "Yes."

While each company's conditions and costs may vary, it is felt that they are, within reasonable limits, approximately the same and can be used to make some general observations, calculations and conclusions.

Information available from various companies throughout the country indicates that the frequency of customer service calls per year per consumer average from 1.0 to 1.5 in the western part of the country. The average in the eastern part of the country is 1.0 to 2.0. The average cost per service call is $3. While it has been difficult to determine what percentage of these service calls are owing to dust trouble, it is of interest to note that the companies using filters either in special localities with known dust troubles, or as a general policy throughout their systems, are the ones experiencing the lowest frequency of service calls. It is estimated from surveys of several prominent gas utilities that upward of 25% of their service calls are due directly to dust.

From these general figures above, it appears that several approaches may be taken in developing proof of the economics of using house-type filters.

For example: One utility with approximately 100,000 customer service traps in operation reports an average of only 0.66 customer service calls per year per customer. More than 95% of their installed traps last, without servicing, the life of the meter change period, which is now nine years. Somewhere along the line these traps are partly responsible for this low incidence factor of 0.66 as compared to from 1.0 to 2.0 elsewhere.

In round figures, assume this company is saving 25% of the low figure of one service call per customer per year on 100,000 customers at $3 per call. The saving would be (0.25 x 100,000 x $3) or $75,000. This is equivalent to the purchase cost of about 33,000 customer service dust traps.

Right here is where the economists can take over. Take your pick of the following observations.

1. In the above statement, $75,000 spent for traps in one year might conceivably save 25% of one service call per year on 33,000 customers so equipped. At $3 per call this would amount to 0.25 x 33,000 x $3 = $25,000 per year. On this basis, the return on investment would be 25,000/75,000 or 33.3% per annum or the investment would be amortized in three years. Add to this the indeterminate, but important, factor of improved customer relations.

2. Customer service dust traps can be considered preventive equipment. On new meter sets would they be considered capital investment or a maintenance or operating cost?

3. Customer service dust traps installed on old sets could be considered preventive or remedial equipment. Would they be considered capital, maintenance or operating cost?

4. Anyway you "slice it" customer service dust traps will save money, manpower, assure cleaner and more accurate operating meters and regulators, and improve customer service relations. ■

How to keep progress reports on street crew performance

This article has been adapted from a paper presented by James S. Carlyle, San Diego (Calif.) Gas & Electric Co. at the PCGA distribution conference in April.

BECAUSE wage scales vary from year to year, and overtime bonus pay distorts the wage-per-hour picture, San Diego Gas & Electric Co. has adopted a feet-of-pipe-installed-per-manhour unit in its continuing study of street crew efficiency. The company feels that by rejecting the more generally accepted concept of labor-cost-per-foot-of-pipe-installed, it has been able to obtain a more accurate idea of labor costs and efficiencies.

Begun in 1947, the program for measuring the accomplishment of street crews was instigated primarily for three reasons. First, in order to gauge the effect of general changes in work standards and policies, the company needed a measure of the over-all accomplishment of the crews engaged in installation of pipe. The effect of outside influences, such as increased or decreased volume, were also factors that had to be determined for efficient operation.

Observation

The second reason for initiating the program was to aid the supervisor's observation and judgment as to the progress of the individual foreman. It would also serve as a warning when a foreman had fallen into poor work habits and might need help with his job planning and execution.

Third, it was thought that such a program, by furnishing the foreman with a regular report on his accomplishment as compared with that of other foremen in the group, would give him added incentive to improve his own procedures.

Additional factors

Besides the distorting influences of overtime and fluctuating wage levels, factors such as driving distance to and from the job, type of soil, condition of pavement, traffic conditions, and amount of mechanized equipment used, were factors which tended to favor certain crews and place others in a bad light. It was frequently possible for a few tough jobs to cause a wide variance in units from month to month. This problem was solved by compiling figures used for comparison over periods of six months. Distorting influences caused by poor working conditions, complicated jobs, and lack of sufficient equipment were thereby minimized.

Early in the study it was noticed that crews engaged in jobs involving very small amounts of pipe installed did not come up to the standards of other crews. These crews, working on changes of meter locations and short leakage renewals, were placed in a poor light, so the company eliminated consideration of all jobs on less than 20 ft of pipe.

Also, crews engaged in installation of large diameter pipe did not lay as many feet per hour as did those working on smaller pipe. These jobs were so infrequent, and varied so greatly in cost, that it was difficult to establish a pattern. For that reason, only mains of 1- or 2-in. diameter were included in the study.

At the present, four categories of pipe installation are considered in the street crew study. New mains, main renewals, new services, and service renewals are each treated separately because of the varying types of operations involved in their installation.

Average derived

When a foreman's feet-of-pipe-installed-per-manhour unit has been computed for a six-month period, an average feet-per-manhour figure is derived. This, in turn, is compared with those of the other foremen by dividing it by the group average. For example, if a foreman has a unit of 3.69 ft per manhour, and the group average is 3.31 ft per manhour, his relative labor is expressed as follows:

$$\frac{3.31}{3.69} \text{ or } 90\%$$

In other words, he has expended 10% less labor (or time, or money) than the average for the group.

Another report is furnished by the company accounting department which supplements the comparative efficiency report. This is a comparison of the estimated cost of a main installation with the actual cost. When a group consistently fails to complete its jobs within the estimated cost figures, the foreman is aided by his supervisor in improving the group's job planning technique.

PROGRESS REPORT CHARTS ARE ON THE FOLLOWING PAGES ▸

Street crews' progress reports

How to use the tables t

MAN HOURS SUMMARY

New Gas Service Installation

November, 1954 — Six Months Ending November, 1954

Foreman Number	No. of Services	Average Length	Feet Of Pipe	Man Hours	Feet per Man Hour	Labor % of Av	No. of Services	Average Length	Feet Of Pipe	Man Hours	Feet per Man Hours	Labor % of Av
1	-	-	-	-	-	-	8	38	668	162	2.89	116
2	8	50	404	116	3.48	97	52	60	3135	852	3.68	91
3	-	-	-	-	-	-	-	-	-	-	-	-
4	18	39	701	214	3.28	103	71	47	3322	990	4.81	69
5	25	56	1395	753	1.85	182	40	74	3130	1203	1.79	186
6	-	-	-	-	-	-	6	72	432	197	1.31	101
7	13	39	503	146	3.23	104	49	57	2785	698	3.98	84
8	30	61	1827	344	3.27	95	94	65	6077	1781	3.40	96
9	37	62	2291	580	3.95	83	128	58	7379	2322	3.09	108
10	-	-	-	-	-	-	2	58	116	38	3.00	111
11	-	-	-	-	-	-	23	60	1397	405	3.11	107
12	2	80	161	49	3.40	99	19	57	1114	390	2.70	125
13	2	80	161	49	3.40	99	82	51	4181	1758	2.38	146
14	-	-	-	-	-	-	-	-	-	-	-	-
15	25	64	1612	490	3.29	103	119	55	6583	2074	3.17	105
16	-	-	-	-	-	-	-	208	208	82	2.54	121
17	3	55	166	36	4.61	73	88	54	4788	1238	3.86	84
18	-	-	-	-	-	-	24	68	1642	441	3.73	123
19	32	47	1497	438	3.36	102	120	57	7460	2233	3.34	102
20	2	82	164	86	1.44	234	51	35	1774	535	3.32	101
21	-	-	-	-	-	-	-	-	-	-	-	-
22	33	60	1989	344	5.77	58	64	63	4022	801	5.02	66
23	-	-	-	-	-	-	-	-	-	-	-	-
24	17	62	1059 *	330	3.21	100 *	117	55	6437 *	1897	3.40	98 *
25	-	-	-	-	-	-	11	25	275	100	2.75	138
26	6	64	380	108	3.61	93	180	32	5760	1596	3.69	90
27	-	-	-	-	-	-	2	22	44	11	4.00	92
28	-	-	-	-	-	-	19	22	1218	399	3.18	101
29	3	39	86	39	2.06	114	15	37	1186	336	3.57	89
30	-	-	-	-	-	-	5	39	1936	432	3.84	164
31	12	61	729	232	3.11	102	50	38	2100	617	3.18	101
32	8	55	2821	890	3.73	98	259	58	15169	3767	3.84	97
33	-	-	-	-	-	-	13	60	773	231	3.34	107
34	32	54	1744	536	3.25	104	113	59	6841	2134	3.19	102
35	-	-	-	-	-	-	4	58	232	77	3.01	98
36	1	57	57	15	3.80	99	6	82	689	110	6.44	73
37	-	-	-	-	-	-	-	-	-	-	-	-
38	7	58	405	124	3.68	97	35	58	2004	617	3.21	101
39	3	95	95	8	1.16	290	4	76	303	54	5.59	60
40	-	-	-	-	-	-	6	67	401	98	5.13	85
41	-	-	-	-	-	-	-	11	11	4	4.13	65
42	-	-	-	-	-	-	3	58	174	82	1.68	139
43	-	-	-	-	-	-	10	50	496	127	3.62	119
44	1	39	39	42	.93	362	32	47	1498	699	2.36	149
45	-	-	-	-	-	-	-	-	-	-	-	-
Total	349		19,951	9916			1967		104,529	31,305		
Average	-	57	-	-	3.37	100	-	53	-	-	3.34	100

FIGURE 1 — * SEE FIGURE 3 & 4 — San Diego Gas & Electric Co. Gas Department

Fig. 1. Basic data, development of foot per manhour units, and labor as a percent of average for all foremen.

MAN HOURS SUMMARY

Service Renewal Installation

November, 1954 — Six Months Ending November, 1954

Foreman Number	No. of Services	Average Length	Feet Of Pipe	Man Hours	Feet per Man Hour	Labor % of Av	No. of Services	Average Length	Feet Of Pipe	Man Hours	Feet per Man Hour	Labor % of Av
1	-	-	-	-	-	-	10	32	327	279	1.32	129
2	6	51	305	70	2.93	109	98	66	6533	1566	4.04	69
3	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	3	30	91	18	3.29	94
5	6	38	228	120	2.46	125	69	24	1658	658	2.52	173
6	6	75	454	152	2.98	108	58	24	1395	1017	1.37	88
7	-	-	-	-	-	-	38	173	6565	2107	3.11	202
8	-	-	-	-	-	-	2	50	99	44	2.27	117
9	-	300	300	93	3.24	222	23	64	1461	663	2.21	152
10	-	185	185	93	1.99	137	111	56	6272	1796	3.52	92
11	-	185	185	93	1.99	137	78	21	1598	1098	2.45	161
12	-	222	222	93	2.39	164	61	18	1098	515	2.13	139
13	12	82	779	250	3.11	138	63	57	3603	981	3.67	188
14	-	-	-	-	-	-	4	39	156	52	3.00	154
15	1	49	49	39	1.26	344	22	60	1316	411	3.20	170
16	-	-	-	-	-	-	13	65	851	186	1.13	82
17	-	-	-	-	-	-	-	21	21	21	1.00	192
18	-	-	-	-	-	-	10	50	498	122	3.88	79
19	16	54	868	248	3.50	109	97	32	3057	1065	2.87	134
20	-	-	-	-	-	-	-	-	-	-	-	-
21	10	51	511	136	3.76	99	10	51	511	136	3.76	99
22	6	247	1482 *	384	3.73	117 *	84	88	5280 *	1336	4.12	97 *
23	4	158	632	213	2.97	93	4	82	329	93	3.90	85
24	4	158	632	66	3.98	99	4	82	329	93	3.90	85
25	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	2	22	44	12	3.36	78
27	-	-	-	-	-	-	24	62	1527	442	3.19	158
28	-	-	-	-	-	-	8	40	320	103	3.22	154
29	-	-	-	-	-	-	11	50	548	199	2.75	128
30	4	58	230	90	2.50	123	11	50	548	180	3.04	141
31	4	58	230	73	3.15	117	72	28	2015	688	2.93	136
32	-	-	-	-	-	-	11	82	897	253	3.55	165
33	2	88	177	68	2.60	158	82	61	5009	1128	4.44	84
34	39	62	2417	318	3.58	93	-	-	-	-	-	-
35	-	-	-	-	-	-	-	-	-	-	-	-
36	12	79	954	238	4.00	96	14	73	1011	277	4.38	73
37	-	-	-	-	-	-	17	77	1309	329	3.97	80
38	-	-	-	-	-	-	57	64	3625	901	4.03	72
39	-	-	-	-	-	-	2	77	154	38	4.04	170
40	-	-	-	-	-	-	72	28	2036	1301	1.56	-
41	-	-	-	-	-	-	-	-	-	-	-	-
42	2	34	67	28	2.39	128	19	88	1662	586	2.80	115
43	-	-	-	-	-	-	1	20	20	25	.80	199
Total	130		6958	2278			1054		68,851	21,551		
Average	-	58	-	-	3.07	100	-	65	-	-	3.19 **	100

FIGURE 2 — * SEE FIGURE 6 & 7 — ** SEE FIGURE 3 & 4 — San Diego Gas & Electric Co. Gas Department

Fig. 2. Basic data, development of foot per manhour units, and labor as a percent of average for all foremen.

On Fig. 1, foreman number 24 has earned a labor-percent-of-average of 98 for installing new service lines during the six months period ending November, 1954. The supervisor can compare this record with that for any of the other foremen for the same period.

When the data can be collected, a year's tabulation of the Man Hours Summary *(Fig. 1)* is prepared as shown on *Fig. 5* and the November value (98) is posted to it. This table permits a long range study of an individual foreman's labor-percent-of-average in comparison with the over-all average or with other foremen. Then, the data on the Labor for Each Foreman report *(Fig. 5)* is graphically presented in the form of the upper graph in Fig. 6. Note that the value of 98 from *Figs. 1* and *5* appears on the illustrated example for foreman number 24.

Each foreman is given a monthly report, in the form shown on *Fig. 7*, that shows his labor-per-cent-of-average for the various construction classes, and number 24's record of 98 for November is, of course, inscribed thereon along with his record for just the month of November

FEET OF PIPE INSTALLED PER MAN HOUR BY ALL FOREMEN

Average For The Past 6 Months

Service Renewals

YEAR	1951	1952	1953	1954	1955
JANUARY		2.79	2.44	3.08	3.58
FEBRUARY		2.82	2.76	3.00	
MARCH		2.75	2.84	2.98	
APRIL		2.66	3.01	3.06	
MAY		2.97	2.99	3.06	
JUNE		2.79	2.99	3.05	
JULY	3.19	2.83	2.94	3.05	
AUGUST	3.13	2.92	2.92	3.07	
SEPTEMBER	3.14	2.94	2.95	3.00	
OCTOBER	2.92	2.27	2.98	3.17	
NOVEMBER	2.78	2.36	3.00	3.38 *	
DECEMBER	2.82	2.28	3.06	2.95	

* SEE FIGURES 2 & 4 — San Diego Gas and Electric Company Gas Department

Fig. 3. A tabulation of the average for all foremen in feet per manhour.

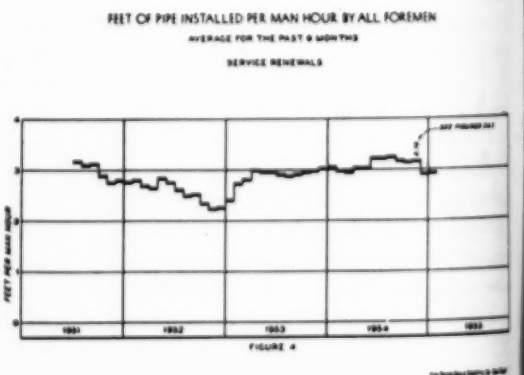


Fig. 4. A plot of the data shown in Fig. 3.

find comparative performance efficiencies

(102, from *Fig. 1,* Man Hour Summary).

Other reports are made, and these apply to all classes of construction. For example, *(Fig. 2)* shows foreman number 24 had a labor-percent-of-average for service renewal installation for six months ending in November of 77. This would be carried to a report exactly like *Fig. 5,* and *Fig. 6,* lower, shows a plot of the data for number 24 that was taken from this table.

This figure (77) is then posted on the report shown on *Fig. 7* along with the November value of 82, in the proper classification.

The average feet-per-manhour figure is used to prepare the year-by-year summary shown on *Fig. 3,* and the figure 3.19, on *Fig. 2,* was used for illustrative purposes.

Then, *Fig. 3* was reproduced in graphical form on *Fig. 4.* Note that the example, 3.19, was carried over into it.

Fig. 8 reflects the comparison between estimated and actual costs for the various construction functions.

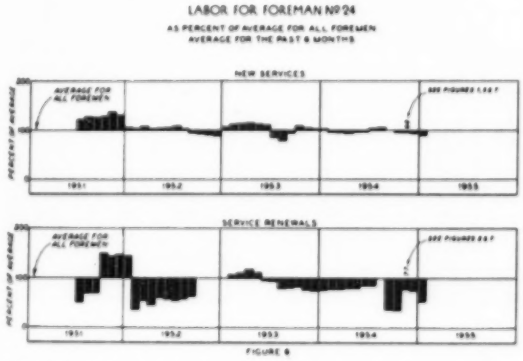


FIGURE 6

Fig. 6. A plot of data from Fig. 5 and a similar tabulation covering service renewals.

SUMMARY OF LABOR
GAS MAIN AND SERVICE INSTALLATION

Foreman No. 24 Date January 15, 1955

Note: In this summary, the average labor per foot of pipe installed by all foremen is considered as being 100%. Labor per foot of pipe installed by the individual foreman is indicated as per cent of the average for all foremen, i.e., 80% would mean 20% below the average, 110% would mean 10% above the average.

	Current Month - November, 1954		Past 6 Months	
	Feet Installed	Labor % of Average	Feet Installed	Labor % of Average
1" to 2" Mains - New	2,289	134	16,048	100
1" to 2" Mains - Renewal	-	-	2,100	91
New Services	1,058	102	6,488	98 *
Service Renewals	538	82	642	77 **

* SEE FIGURES 1 & 6
** SEE FIGURES 2 & 6

San Diego Gas and Electric Company
Gas Department

FIGURE 7

Fig. 7. This summary of labor is issued monthly to each foreman. It shows his standing as compared to the average for all foremen.

LABOR FOR EACH FOREMAN
As Per Cent of Average for all Foremen
Average for the Past 6 Months
New Services
1954

FOREMAN NO.	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	86	76	177	-	-	-	130	139	135	118	116	116
2	68	74	77	79	77	74	85	82	78	92	91	100
3	-	-	-	-	-	-	-	-	-	-	-	-
4	78	89	87	89	92	86	76	73	62	62	69	79
5	201	208	212	233	244	234	217	229	232	210	186	191
6	89	90	90	94	94	76	77	72	61	103	101	118
7	112	127	128	132	-	142	97	78	78	81	84	82
8	97	95	97	104	100	99	97	100	101	99	94	96
9	104	104	98	100	100	106	108	112	98	111	108	97
10	179	153	155	156	157	149	121	121	114	113	111	115
11	113	113	122	118	102	89	84	82	80	83	107	142
12	111	111	111	133	137	141	169	150	156	130	134	136
13	151	143	144	142	140	139	134	139	152	146	140	140
14	-	-	-	-	-	-	-	-	-	-	-	-
15	93	94	99	102	100	99	99	104	92	101	105	108
16	170	174	178	175	182	186	181	174	169	172	131	-
17	86	82	79	76	74	70	79	83	83	85	86	90
18	-	-	-	-	-	-	-	-	312	125	123	123
19	97	98	99	105	108	106	104	105	104	97	99	101
20	121	124	126	101	73	74	73	69	67	66	101	101
21	-	-	-	-	-	-	-	-	-	-	-	-
22	91	90	91	56	56	56	75	81	79	76	66	64
23	-	-	-	-	-	-	-	-	-	-	-	-
24	101	98	97	96	98	99	103	104	100	98	82 *	96
25	127	134	126	86	87	87	91	87	85	124	111	121
26	69	71	73	83	84	89	99	100	97	92	90	89
27	54	64	89	104	106	118	87	86	84	83	82	83
28	159	-	-	51	52	52	51	51	84	107	105	104
29	126	109	110	114	117	110	110	111	104	104	94	133
30	103	68	121	-	189	190	144	143	140	155	149	149
31	79	97	101	130	138	149	139	126	114	111	105	105
32	94	90	92	86	88	86	86	87	86	86	87	89
33	97	103	104	107	107	142	136	135	151	145	143	100
34	97	96	97	96	98	99	102	104	108	112	107	104
35	67	44	53	71	72	72	69	68	53	51	50	57
36	-	-	-	-	-	-	-	88	78	75	75	75
37	-	-	-	-	-	-	-	-	-	-	-	-
38	74	74	64	64	66	79	79	80	95	103	101	94
39	89	92	95	98	100	107	118	-	-	-	60	88
40	68	69	74	76	82	103	144	163	149	122	65	54
41	-	-	-	-	-	-	-	-	86	82	81	81
42	179	177	215	218	221	211	163	162	187	202	199	-
43	55	63	-	-	131	131	106	105	122	98	92	93
44	242	240	219	178	151	151	121	126	120	116	119	118
45	132	132	133	88	116	116	122	122	128	142	148	147
Average	100	100	100	100	100	100	100	100	100	100	100	100

* SEE FIGURES 1, 6 & 7

FIGURE 5

San Diego Gas & Electric Company
Gas Department

Fig. 5. A record of the standing of each foreman as compared to the average for all foremen.

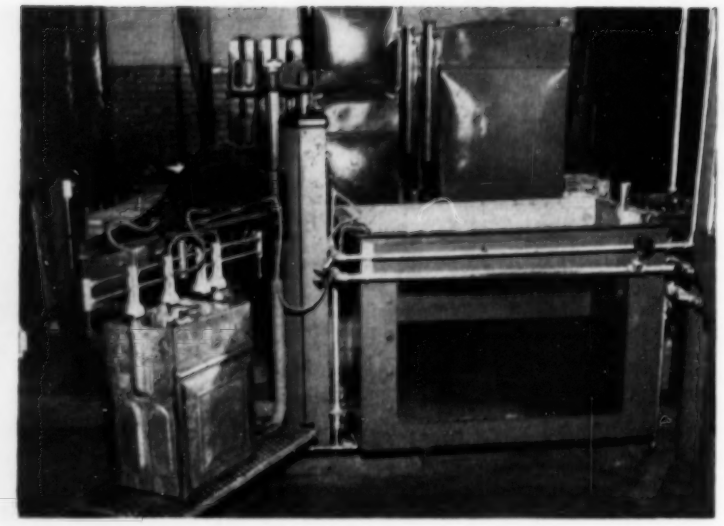
COMPARISON OF ESTIMATED AND ACTUAL CHARGES
Gas Main Construction Orders
November, 1954
(Dollars)

JOB NUMBER	MATERIAL Est.	MATERIAL Actual	DIRECT CHARGES Est.	DIRECT CHARGES Actual	PAVEMENT Est.	PAVEMENT Actual	LABOR Est.	LABOR Actual	T & W EQUIP. Est.	T & W EQUIP. Actual	GROSS CONST. Est.	GROSS CONST. Actual
101640	19	11			20	29	64	50	21	9	143	115
101653	386	359		6	48	87	577	534	305	218	1412	1372
101657	109	276		8			237	276	59	138	480	651
101663	24	24				11	108	70	30	21	193	148
101680	29	23		17		12	87	96	24	41	166	218
101685	48	43			27		136	99	35	28	287	301
101686	38	42			99	28	133	112	36	14	349	232
101689	75	79					240	171	75	21	461	325
101697	41	39			74		143	139	42	42	294	249
101699	83	59				28	182	153	63	46	385	336
101723	96	70				15	161	167	56	40	367	345
101727	102	111			192	14	369	134	98	38	583	347
101735	6	7				32	26	46	7	6	46	104
101736	182	173		41	60	15	351	328	110	123	795	791
101742	31	22					101	59	27	11	188	110
101743	13	9				28	37	33	10	20	71	85
101744	36	27				98	116	103	32	41	218	302
101747	29	30					128	88	35	44	229	190
101748	394	357			209	324	591	575	167	146	1565	1612
101751	19	39					63	67	21	27	122	156
101760	92	105			73	65	145	83	50	27	410	318
101778	36	28			57	28	104	67	28	7	360	152
101779	183	166			51	15	387	177	110	58	729	485
101780	66	61					191	100	66		383	193

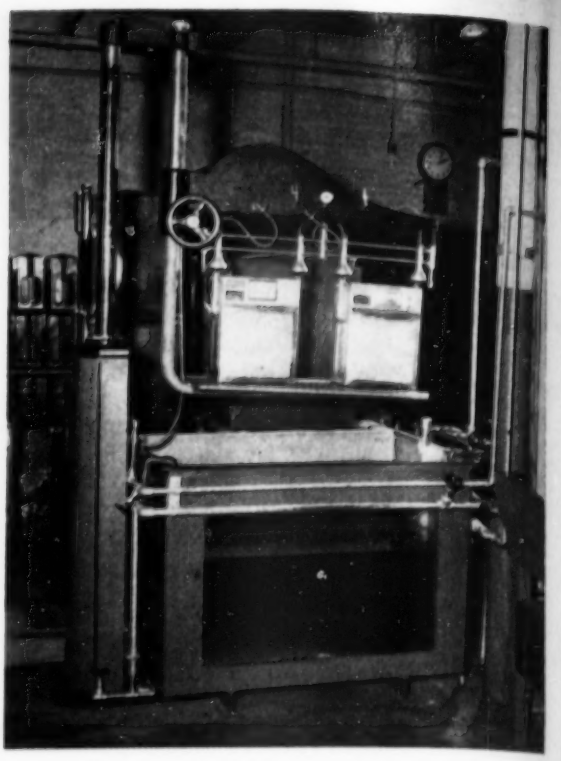
San Diego Gas & Electric Company
Gas Department

FIGURE 8

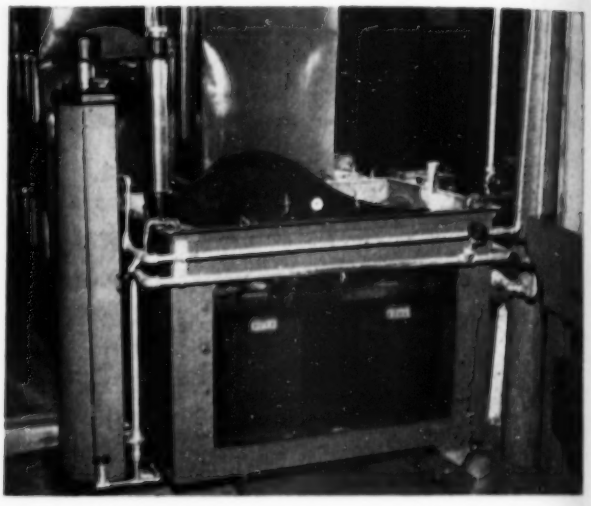
Fig. 8. This breakdown of estimated and actual cost of main installations serves as an aid to detailed analysis of completed jobs.



DUNKING DEVICE . . . The air-operated lift, which transports meters into the test tank, accommodates meters in sizes from 10- to 60-light. Air line clamps are mounted on rods attached to a bracket that rides up and down the hanger pipe.



POISED FOR THE DIVE . . . Two meters in place over the tank, ready for lowering. Channel at right of interior of tank guides table down into the water.



GLUB, GLUB . . . Now submerged, meters can be checked for solder-seam leaks. Plexiglas front permits easy visual inspection.

How to give a meter

A double-quick dunking

WHILE our gas meter maintenance problem differs but little from other companies of corresponding size, nevertheless the expenditure required to repair more than 6000 gas meters a year represents a sizeable amount in time and materials. In these days of steadily advancing costs, it is essential to consider avenues leading to cost reductions.

Our repair load fluctuates with 5s, 10s, 20s, 30s, and occasionally 60- and 100-light meters, but with more 5s and 10s than other sizes. In handling these sizes, we have developed a fast, efficient, and dependable repair sequence, calling for air testing under water.

Analysis and study of our repair procedure indicated that perhaps a relatively large portion of total time was used in the submersion test. While reasonably adequate means existed for the mechanical immersion of 5- and 10-light meters, such was not the case with 20- and 30-light meters and larger sizes.

While neither the volume of gas meters being repaired nor the variations in size in our shop particularly lends itself to so-called straight line production methods, it did seem possible to devise some more expeditious means of handling our normal size range as well as volume.

The automobile industry, long a leader in mechanization, has used for several years an air-operated lift for the raising and lowering of passenger and truck radiators into a tank for testing purposes. These lifts are usually positioned at the side of a tank, and, operated by air, they raise, swing over and lower radiator cores into a tank for air testing about as we do with gas meters. With the help of Hydraulic Products Co., Providence, manufacturers of the Dyna Lift, we suggested a machine to meet the requirementts of our shop, which are probably fairly typical.

We used a model having a 38-in. ram travel, which is sufficient to handle from 5- to 60-light meters. The size of the work table, made of perforated metal supported by a hanger pipe, was enlarged so that we could place two 5s, or two 10s, or a 20-, 30-, or 60-light meter upon it.

By so doing, we are able to load and test two 5s or two 10s at one time, reducing the immersion test time by about one-half. And with no rearrangement of equipment necessary, the flexibility of loading a 20 or a 30 has been improved.

The clamping of air lines to the top of meter tube screws is through meter testing nozzles of aluminum, which fit 5- to 60-light meters without adjustment. These nozzles slide freely back and forth on two parallel steel rods, which are under and are supported by a long meter-testing bracket. This bracket in turn is supported by and slides up and down on the hanger pipe. It is raised or lowered by a 7-in. hand wheel working a gear and rack. The rubber air seals are recessed in the bell-shaped ends of the meter testing nozzles. Hose and pet cocks lead from the bracket to the tops of the nozzles, while in the center of the bracket is an air gauge and control valve.

By this arrangement we may now load meters from the floor or bench on to the meter testing table, clamp the air lines to the meter tube screws by a turn of the hand wheel, swing the load over the tank and immerse them without further manual effort; and, of course, we reverse the process to remove them.

Guiding the meters into the tank was a minor problem, but it was simplified by placing a small channel upright in the tank at one end. It protruded a few inches above the tank and was so cut away that after loading, the table was swung over the tank, engaged the channel and guided down into the tank.

For quicker detection of solder leaks under water, there is a large front panel of Plexiglass in the tank, while at the bottom and rear is an adequate submarine light.

Although of larger capacity than the equipment we had before, our Dyna Lift takes up no more space than did our more limited apparatus. It is more flexible and has reduced the time of our immersion operations. And in my opinion, with pride in new, improved and more adequate equipment, there is a perceptible quickening in the over-all tempo of our shop. ■

Gas Service Co. fights back

FOR ECONOMY... it's 7 to 1 IN FAVOR OF GAS COOKING!
AN ELECTRIC COMPANY HAS SAID... "THE AVERAGE K.C. FAMILY COOKS ELECTRICALLY FOR LESS THAN $2 A MONTH."
if THIS IS TRUE... THEN THESE SAME FAMILIES CAN COOK WITH GAS 7 YEARS FOR WHAT THEY NOW PAY TO COOK ONE YEAR ELECTRICALLY.
Economy IS ONLY ONE OF THE MANY ADVANTAGES OF COOKING WITH GAS!
THE GAS SERVICE CO.
DON'T YOU BELIEVE
THAT ANY FUEL IS CLEANER THAN GAS FOR COOKING!
NO RANGE GIVES YOU CLEANER COOKING THAN THE STARTLING NEW GAS RANGES!
THE GAS SERVICE CO.
if
12 MONTHS X $2 = $24
...HERE ARE SOME INTERESTING FACTS
if "THE AVERAGE K.C. FAMILY COOKS ELECTRICALLY FOR LESS THAN $2 A MONTH." (AS STATED IN AN ELECTRIC COMPANY'S AD) THAT IS ABOUT $24.00 A YEAR.
if THESE SAME FAMILIES COOK WITH GAS. THEY CAN COOK FOR OVER 7 YEARS AT THE COST OF COOKING ONE YEAR ELECTRICALLY!
if YOU'RE INTERESTED IN SAVING MONEY. THIS IS ABOUT $144 SAVED DURING THE 7-YEAR PERIOD.
THE GAS SERVICE CO.
THIS ISN'T HAY
RECENT ADS HAVE STATED AS A FACT THAT "THE AVERAGE K.C. FAMILY COOKS ELECTRICALLY FOR LESS THAN $2 A MONTH."
(THIS IS ABOUT $24.00 A YEAR)
if THIS IS A FACT... THEN THESE SAME FAMILIES CAN COOK 7 YEARS WITH GAS FOR WHAT THEY NOW PAY TO COOK 1 YEAR ELECTRICALLY!
BY COOKING WITH GAS DURING THE 7-YEAR PERIOD, THE SAVINGS TOTAL $144.00
THIS ISN'T HAY!
You don't need white gloves to cook with Gas.
THE GAS SERVICE CO.

In its current competitive fight with the electric company (see Thermally Thinking), Gas Service Co. has been running this series of ads stressing the cost saving with gas and refuting the false claims of the competition that gas ranges are not clean. Note the tag line on the lower right-hand ad "you don't need white gloves to cook with gas," which has reference to the "White gloves clean" campaign of the electric companies, which the gas company has been offsetting with its own white-gloves campaign.

GAS reviews

A study of the accelerated processing of rate changes

Rather remarkable progress has been made in two and a half years in easing the problem of long drawn-out processing in gas distributing utilities' rate cases. Since September 1952, when W. A. Dougherty, counsel for the Consolidated Natural Gas System, brought the problem to the attention of the American Bar Association in a formal address, gas utilities in at least 24 different states have been given the benefit of such clauses in one or more of their rate schedules.

The moral of this is clear: If everyone had sat back and said nothing could be done about it, the likelihood is that little would have been done, but when the question began to be aired and emphasized, substantial corrective procedures have since been developed.

Thus did intelligent action flow out of informed opinion, according to the interim report of the AGA subcommittee on accelerated processing of rate change, delivered at the recent Cincinnati management conference by Walter J. Herrman, the group's chairman. And on this basis the subcommittee has proceeded to explore "all possible corrective measures, and to make the facts and suggested corrective measures known to those who have the power to do something about it."

The first step in the committee's study was the analysis of 193 rate increase applications made over the past few years to determine the facts as the range of processing times. The results of this study and succeeding studies are included in these excerpts from the Herrman report:

TWENTY-TWO of these applications were denied, after time intervals ranging up to a year or more. Of the 171 increases granted, 13 cases ran over a year and a half before final rate relief was made effective.

At the other extreme, 17 cases were processed within 90 days, and a total of 62 companies received final relief within six months. While it may be assumed that the case included in these extremes involved differing degrees of complexity, the fact that so large a percentage was processed so quickly justifies an inquiry as to the whys and wherefores underlying the differences.

If we are able to learn why certain cases move slowly, while others are completed expeditiously, we should be able to help all companies speed up their processing accordingly.

The second subject of study has been the statutory provisions of the basic utility law which governs the time period between the filing and putting into effect of new rate schedules. The 4-e procedure in the Natural Gas Act permits a natural gas company subject to the act to file a new higher tariff to become effective upon 30 days' notice. It is the usual practice for FPC to suspend the new rates for five months, the maximum suspension period. Thereafter, unless there has been a hearing and decision by the commission, the new rates become effective under bond, with any increase subject to refund after review.

This 4-e procedure permits a company to recover increased costs with only a nominal delay. However, since its customers are in most cases other utilities, they may be hurt if they do not have the same kind of statutory machinery available to them to pass along their increased costs to their customers.

Actually, only seven states have statutes comparable to the 4-e procedure of the Natural Gas Act, although it appears from our initial investigation that 18 other states have somewhat equivalent provisions that permit utilities to put new rates into effect without hearing after suspension periods varying from one to 13 months. In 22 states, no provision of any kind is available, and unfortunately these include many of the large gas-consuming states such as California, Illinois, Indiana, Michigan, New Jersey, Ohio, Pennsylvania, and Wisconsin, where the need for relief is most serious. Some of these states have endeavored to solve the problem by so-called "offset" proceedings, which are intended to recover specific cost-of-gas increases. In practice, these offset methods have been life-savers to the distributing companies, but they also have their unsatisfactory points. For one thing, there seems to be a tendency for such cases to lose their offset character and to become expanded into full-fledged rate cases. When this happens, it is relatively easy for protestants to introduce delaying actions, which may result either in unjustified compromises on the part of the utility or failure to recover the increased costs promptly as they occur.

In addition to the 25 states in which increased rates can be put into effect after a suspension period, there are six where the commission must act on a rate filing within a specified time, ranging from seven to 11 months. Thus, we find 31 states with some kind of statutory provision that has the effect of limiting the regulatory lag to a definite period, ranging from one to 13 months.

Automatic rate adjustment plans such as are now in effect cover a wide range, from the completely comprehensive plan like the Washington and New Jersey plans, which adjusted retail rates to produce a specified rate of return on rate base, to simple fuel adjustment

clauses, which modify rates to reflect changes in only a single major item of expense.

Two gas utilities that have comprehensive plans successfully in operation at the present time are the Cincinnati Gas & Electric Co. and the Minneapolis Gas Light Co. The first of these does not carry the formula through to rate base and rate of return, but it does incorporate an all-expense escalator provision, which has the effect of adjusting rates automatically to reflect increases and decreases in gas costs, wages and taxes other than excess profits taxes. The Minneapolis plan is a basic part of its city franchise, which provides that rates shall be adjusted annually to reflect the rate of return under a specified formula which has been in operation since 1935.

As to fuel cost adjustment clauses, a wide majority of the electric utilities have over the years incorporated clauses in their rate schedules that have the effect of correlating charges to customers with the cost of coal or oil or gas used for steam generation. Almost all manufactured gas companies have had similar clauses in their tariffs. Because fuel prices tended to fluctuate rather frequently, there has been a large saving in the way of time and expense that would otherwise be required to process the required rate changes through formal rate proceedings.

Prior to the great development in long distance high pressure transmission lines, natural gas sources were mostly local and with gas being generally in adequate supply, its cost to distribution companies was for many years a relatively stable factor in total expenses. This picture has changed drastically. While, for example, the cost of gas to a typical distribution utility like Southern California Gas Co. was 24% of revenues 25 years ago, today it amounts to over 44%. And it is increasing constantly.

It is easy to understand, in light of these facts, why cost of gas adjustment clauses has suddenly blossomed out as an important rate-making factor. According to the Ripley* report, only three companies had such clauses in effect in January 1950. At the end of 1953 43 companies in 23 states had cost-of-gas adjustment clauses in their rate schedules.

Of the 24 states where adjustment

*AGA rate subcommittee on rate adjustment clauses, December 1954 report, Douglas Ripley, Long Island Lighting Co., chairman.

Processing rate changes... A major delay results from cost-of-service studies

clauses were authorized, 11 were in addition to the 31 states having statutory provisions for putting increased rates into effect after suspension. This makes a total of 42 states with some form of direct relief from the regulatory lag problem—at least for gas companies. The exceptions—states where no comparable relief of either type is available—include Florida, where the state commission was only recently established, Kansas, Montana, Tennessee, Texas, and California.

Maynard Turner, vice president of the Cincinnati Gas & Electric Co., lists the following among the more important miscellaneous means of alleviating, or correcting for, regulatory lag in rate proceedings:

(1) Maintenance of good public relations (which reduces resistance to rate increase applications, with a saving of time as a result).

(2) Rate case presentations that are clearly and concisely prepared. A collateral suggestion is that exhibits and testimony should be distributed before the hearing so the parties will be prepared to cross-examine immediately.

(3) Supplying the commission with a monthly or quarterly record of pertinent information, so that it will not be necessary for the staff to make a re-study of operations for each proceeding.

(4) Limiting of cross-examinations to relevant questions.

(5) The setting up, by the commission, of a scheduling procedure and the maintaining of a carefully prepared time table for processing each case.

(6) Using informal conferences, especially for answering detailed and technical questions that are difficult to develop in a formal hearing, and finding agreement, if possible, on controversial items.

Since formal rate cases still take considerable time even after everything possible is done to avoid unnecessary delay, Mr. Turner further suggests that commissions grant an extra provision in the rate return or some other equivalent allowance to permit the company to earn the indicated fair rate of return on the average over a reasonable period.

One of the major causes of regulatory delay that has come to my attention results from cost-of-service studies. It seems to me commissions could reduce rate case delays very considerably by eliminating cost-of-service studies in rate increase or decrease proceedings, where total dollar changes are needed quickly, and take care of rate-spread questions during intervals between revenue cases when the time element is relatively less important.

Finally, I believe sincerely that a great reduction could be made in rate case processing time if commissions would give more attention to over-all end results instead of a great mass of underlying detail. A commissioner in an eastern state once told me that he could pretty well tell whether a company needed a rate increase, and about how

> "On strict 'cost of money' considerations our subsidiary findings indicate that the company's position can be maintained with a 6.1% return at the present time. This figure would no doubt be above the level of confiscation; however, in the present case important considerations point toward the fixing of a rate of return slightly higher than that provided by the 'cost of money' analyses. These considerations include: the record of time during which the company has served at a rate of return substantially below that established as fair and reasonable in the last rate order; the clear possibility of contingencies increasing the company's costs in the future above the now predicted levels as has happened in each of the years during the recent past; 'value of service' considerations; and the other intangibles to which we have already adverted. We believe that under the present circumstances the company is entitled to a return which will in theory at least provide a reasonable cushion against the contingencies which have in the recent past prevented it from actually earning in accordance with its own and with the Commission's estimates. In the light of these factors and in the exercise of our judgment with respect to the entire record, we have concluded that the company should be allowed rates which will provide a return of not more than 6.25% on its net capital invested in intrastate operations." *Chesapeake and Potomac Telephone Co.*, D. C. order No. 4096 (1954).

clauses, which modify rates to reflect much, by a simple inquiry as to the rate of earnings on the book value of the company's common stock in relation to that of other utilities generally. While I realize there are many other factors that should also be looked at, most of these are necessarily subordinate to this single end result criterion, which takes only minutes to evaluate. What matters it if rate base or rate of return or operating expense estimates are calculated to a precise penny and combined in a complex formula if the product of the computation produces an impractical answer?

Manufacturers and utility benefit from service analysis

The portable rotary air compressor has recently made its appearance and is challenging the older reciprocating or piston-type compressor for utility use. D. J. Feaster and M. M. Cammen, both of Ingersoll-Rand Co., discussed the design and compared Ingersoll-Rand's Gyro-Flo introduced in 1951 to earlier reciprocating compressors at the AGA distribution conference held in Cincinnati in April.

THE Gyro-Flo uses a cylindrical rotor fitted with a number of vanes working in radial slots. When the compressor runs, centrifugal force holds the vanes out. The cylinder is larger than the rotor and off-center. The pocket between the rotor, the cylinder, and the vanes on either side first increases and then decreases in volume during a revolution. Where the pocket is increasing in size, air is drawn in through the inlet port. Then, when the pocket decreases in size, the air is compressed and finally discharged through the discharge port. The Gyro-Flo compressor is two-stage, the air flowing through the intake regulator, the first stage, and the second stage. An earlier problem was to supply sufficient oil to prevent undue wear without excessive oil in the discharge air stream. This has been overcome by application of an extremely efficient oil separator permitting use of sufficient oil to provide both adequate lubrication and considerable cooling, with net oil consumption actually less than in earlier piston type models.

The principal disadvantage of the rotary is poor fuel economy at continuous full speed, compared to the reciprocating type. However, normal utility service involves considerable part-time operation during which the rotary runs smoothly and economically while the recipropcating type operates alternately all-on and all-off. The net result is equal economy in overall practical performance, plus uniform air pressure from the rotary to the air tools while the piston type delivers fluctuating air pressure at light loads.

The Gyro-Flo rotary has much fewer moving and wearing parts than has the reciprocating type, making it a simpler and more reliable unit in service; when overhaul is needed, tearing down, cleaning and re-assembling the air end of a 600-cfm rotary can be done in one day whereas two or three days will be required to do the same work on a 500-cfm reciprocating compressor.

Other advantages of the rotary are: Approximately 40% lighter in weight for the same air delivery; more compact in overall size; runs cooler and has lower discharge temperature, which increases life of air hose; and has better balance, reducing vibration which is reflected in lower maintenance costs.

Rotary air compressors vs. piston-type compressors

Field operation data on appliances, to indicate the causes of trouble from controlling devices, materials, construction and design, are invaluable to both manufacturers and utilities, but are difficult to obtain. Servicemen's written reports must be manually read, interpreted and tabulated by skilled personnel, resulting in considerable expense and, at the best, sometimes doubtful accuracy.

At the AGA distribution conference held in Cincinnati in April, Paul W. Kraemer of Minneapolis Gas Co. discussed his company's simple and inexpensive means of having its servicemen record the results of service calls so they can be rapidly analyzed.

THE analysis system incorporates the use of the IBM mark-sensing cards and machines. In brief, pencil marks on the cards are mechanically sensed, classified, and tabulated, all at high speed. The International Business Machines devices are so widely used by utilities for jobs in billing, accounting, and meter reading that they are nearly standard equipment for utilities. It was found that the rental of the equipment one would need for a service analysis is nominal.

The standard IBM card *(Fig. 1)* becomes the service request order form. The card dimensions are about 7½ in. by 3¼ in.

The same card or form is used for the phone clerk to write up incoming orders and for the serviceman to describe the work he did to complete the order. The reverse side of the card is lined for the serviceman to write any detail of comments about the job.

The service analysis is confined to the right-side section of the card, which contains the nine vertical columns of numbers. These columns are the important supplement to the usual information on the service card and are the only subject in further reference to the card.

The vertical columns of numbers and assigned designations are the particulars of the analysis. The serviceman marks the description of the service given on each job card by drawing pencil marks in the appropriate spaces.

The completed order or marked cards collected for a day or week or month or any other period of time are processed through IBM machines. These IBM machines sense the marks, sort, and tabulate the marked information at a rate of about 250 cards per minute.

Vertical column 1 is a list of types of gas appliances. The serviceman always marks the appropriate space for the appliance he serviced.

Vertical column 2 is a list of types of services which require no further explanation. When the description of the service given is listed in column 2 the serviceman marks the appropriate space and makes no additional marks.

Vertical columns 3, 4, 5, and 6 are a list of the items or parts which are principals in the operation of appliances. These items include all the controlling devices of a gas appliance. The serviceman marks the one item in these 4 columns which because of its operation caused the service call. When an item in any of these 4 columns is marked there must be a mark in columns 7 or 8.

Vertical columns 7 or 8 list the failures which the items of the preceding 4 columns might have. A mark is made in column 7 or 8 to describe the cause

of failure of the item.

Vertical column 9 has no permanent number descriptions. We use it to obtain important key information about any particular item or appliance. As a simple example which will also point out the practical application of this whole system, let's follow through on how a new type of pilot burner assembly is affecting service.

We know that a principal cause of clothes dryer service is lint in the primary air openings of pilot burners. Some manufacturers have designed pilots for use in dryers in which primary air must pass by the pilot flame. Through this design the flame is supposed to consume or incinerate foreign matter in the air used for primary aeration of the pilot. We want to know if this incinerator type pilot is effective in the field and should be encouraged or required on all dryers.

We designate arbitrarily for a period of time number "0" in column 9 as the old or conventional type of dryer pilot, and number "1" in column 9 as the new or incinerator type pilot. The serviceman marks the type of pilot in column 9 each time he services a dryer regardless of the type of service he performs.

The analysis of the cards used for the dryer pilot survey would show two important things. It would show from all service calls unrelated to the pilot the proportional number of the two types of pilot assemblies in the field. It would show from a study of pilot service causes the effect of the type of pilot assembly on the amount and kind of pilot service. Knowing the proportion of the types of pilots and the amount of service on each type, it is simple to determine the relative performance of the pilots.

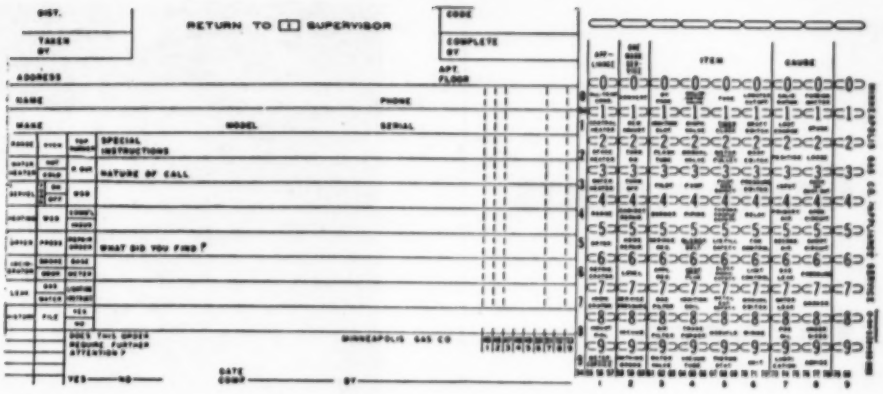


Fig. 1. Service request order form used by Minneapolis Gas Co. in its service analysis program.

For example, assume the incinerator type pilot accounted for 2% of the pilot complaints. Assume that from service cards unrelated to pilots service we found that 20% of the pilots were of the incinerator type. Then, incinerator type pilots would be 10 times less troublesome than others. Information like that for any appliance would be a mandate to manufacturers.

Our present procedure is to have our tabulating department mark-sense and record the service orders daily. After a two- to four-week period, our tabulating department makes a machine tabulation of the information collected. This procedure lets us keep our service file up to date during the time the information is being collected.

Pilot burners are the major source of service on all appliances. At the present time we are conducting a pilot type and service study with the aid of column 9 in *Fig. 1*. We expect the results will be a guide for future pilot burner design. The results will be given to any manufacturer interested.

The total cost of the IBM system has been about $3 per thousand orders. This cost includes the price of the cards and the cost of the tabulation. The cost is certainly minute in comparison to the possibilities and advantages it offers.

Solving corrosion problems at compressor stations

Cathodic protection, corrosion inhibitors, water treatment, and proper design and selection of metals to solve most problems of corrosion in compressor station equipment were discussed by J. C. Berringer in a paper presented at the AGA transmission conference held in Pittsburgh in May.

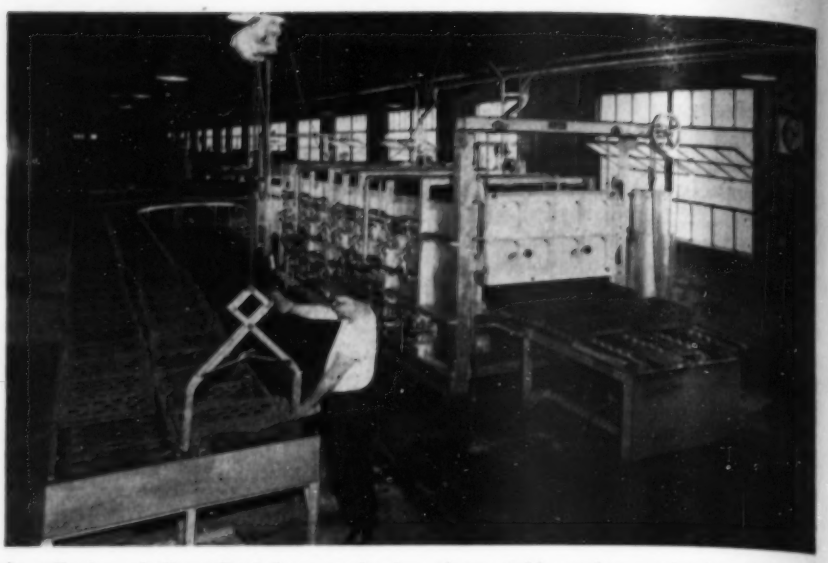
CATHODIC protection is being increasingly applied. Magnesium anodes of various shapes are available for installation in cooling water circulating areas in power pistons and jackets; they should be so placed as to not impede flow of water, and to have a life through normal service periods so that they can be replaced at times of scheduled engine overhaul. Magnesium ribbon has been used in power piston rods but is difficult to maintain.

In tanks enclosing after-cooler coils, use has been made of 1½-in. diameter magnesium rods suspended in the water on 1-ft centers, extending to within 2 in. of the bottom. These rods last about nine months, are easily replaceable and have been quite successful.

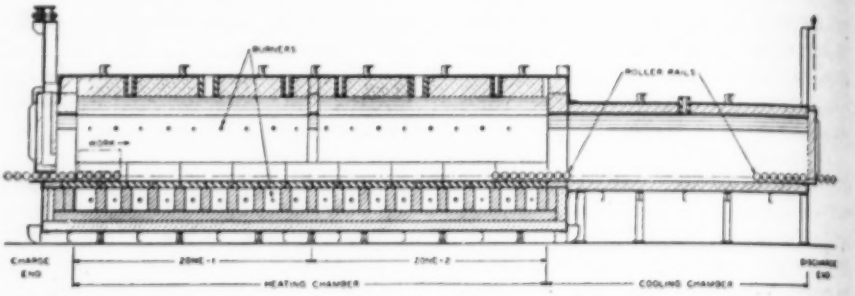
Elevated water tanks are subject to corrosion and are difficult to repair, but a rectifier and anode system will give satisfactory protection. For a 75,000-gal. tank, from 4 to 8 amp is required, depending on the water analysis; junk iron rods can be used, but the recently developed Duriron (a 14.5% silicon cast iron alloy) has been found more convenient. Duriron is relatively noncorrodible when used as an anode and can be employed to discharge as much as 1 amp per sq ft. While one Duriron rod, 1 in. in diameter and 10 ft long, would be theoretically sufficient for a 75,000-gal. water tank, three or more are desirable to give adequate current distribution.

If the gas being compressed contains appreciable hydrogen sulfide, corrosion problems will be encountered. Cylinder walls, piston rings, piston rods, rod packing and discharge valves are usually protected by the normal coating of lubricating oil. Copper intake valves can be protected by injecting lube oil into the gas stream just before it reaches the compressor cylinders. Gasket corrosion can be solved by using soft iron or aluminum instead of copper or copper alloys.

Continuous furnace cuts cost, conserves floor space



Overall view of direct-fired furnace showing charge table pusher mechanism and return gravity conveyors.



Cross section of furnace showing heating chamber of two zones and cooling chamber.

MECHANIZED handling and gas have teamed up to produce more uniform castings for Fremont (Ohio) Foundry Co. at a rapid rate. Replacing two car-bottom furnaces, a new unit anneals and stress-relieves medium-strength grey iron castings of fine grain structure used for many pressure applications.

Automatic feed

Castings weighing up to 75 lb are automatically fed into the two-zone Surface Combustion furnace. Each of the heating zones is 9 ft long and may be set at individual, automatically controlled temperatures, thereby permitting flexible control of the furnace to achieve different cycles.

The heating chamber utilizes automatic proportioning, low-pressure velocity burners located in the furnace side walls and arranged to fire above and below the work. Through the entire range of turndown, a correctly proportioned fuel-air mixture is controlled by only one valve. The front zone of this heating chamber has slightly more heat input capacity than the rear zone.

Each burner has a premix type constant burning pilot. Approximately 2000 cfh of natural gas are required under full production to heat and hold the furnace at about 1450° F.

Attached to the discharge end of zone 2 is a 12-ft cooling section, which is fully insulated and equipped with an adjustable door.

One-man operation

A U-shaped inclined gravity roller conveyor makes it possible for one man to heat-treat as many castings as four men manning the two car-bottom furnaces were able to handle. And the present installation requires only one-half as much floor space. A pusher mechanism at the charge end of the furnace pushes two 18- by 26-in. trays through the furnace on parallel sets of roller rails.

Either of two basic processes is utilized for all heat treated production. All annealing is carried out at a temperature of 1450° F using a push cycle of 11½ minutes with a total furnace time for each tray of 2½ hr. The second process, involving stress relieving at 1000° F, requires a push cycle of 5 minutes, or a total time per tray of 65 minutes. The latter process is usually required for high pressure applications in which castings in service must withstand hydraulic pressures up to 2500 psi. Close control of grain structure, and hence the accurate temperature control that gas affords, are extremely important for these applications.

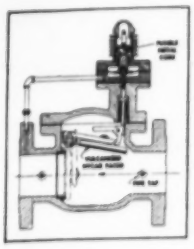
Hoist turnover

The one furnace operator unloads heat-treated castings at the discharge end of the conveyor by means of a hoist turnover arrangement. Castings are dumped into tote boxes and moved to the following operation by fork truck.

GAS new products

To secure further information on products or new literature, simply fill out the coupon and mail, indicating by number the information or literature needed.

1 Shutoff Valve



McRae Corp.'s Sentry Model 2200 shutoff valve (pictured) is designed to close consumer gas lines, either when line pressure reaches a predetermined dangerous high or when temperature in vicinity of valve reaches 200° F or other specified temperature.

The company's Model 2200-1 closes on either predetermined low pressure or over-temperature.

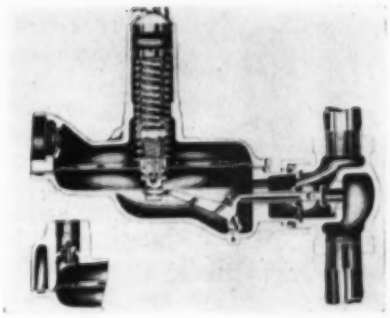
After closure, the Sentry valve makes a positive line seal, even if the diaphragm control is destroyed. After closure because of over-temperature, a new fusible core can be installed in less than a minute.

McRae Corp.

■

2 Service Regulators

Two new 360° swivel-type models of Rockwell Manufacturing Co.'s "173" gas service regulator can be installed in almost any position when equipped



with a new four-positional side drain cover.

The new models—for regular and high-pressure services, respectively, eliminate the need for special left and right hand assemblies and top or bottom inlet.

The new regular model has the same dimensions and performance characteristics as the conventional "173" and is still available with the large bottom vent or top vent cover. And, as before, the internal relief valve is optional.

A swivel connection allows the regulator to rotate through a full 360 degrees without disassembly or removal from the line.

By removal of eight screws, the 4-positional side drain cover can be moved to any one of three positions making it possible for the regulator to vent and drain downward at all times.

The new high-pressure model offers a maximum outlet pressure range of 10 psi and can be used in any application requiring a small capacity regulator with pounds outlet pressure range.

Rockwell Manufacturing Co.

■

3 Arc Welder

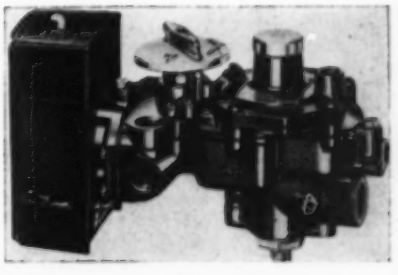
Lincoln Electric Co. has a new universal combination arc welder that provides a choice of either ac or dc welding current. The new machine, called the Idealarc, is available in several combinations.

It can be obtained as an arc welder without the dc current. It is also available as a combination ac and dc machine with selection of either current made through a simple twist of a switch handle. Different output capacities of dc or ac can be combined to fit the machine to the job requirements.

For ac welding jobs the machine provides a single phase transformer type welder. For dc welding, the Idealarc provides dc welding through heavy-duty rectifiers.

Lincoln Electric Co.

■



4 Thermostat-Type Control

A-P Controls Corp. has announced its new 55 ET electric thermostat-type control which has been especially designed for use with the Model 55 Gasapack. (The illustration shows the new ET mounted to the basic control.) A complete kit is furnished with the electric operator: wire, plug-in transformer, wall thermostat, and simple wiring diagram.

Mail this Coupon for **NEW PRODUCTS INFORMATION** / **COPIES OF NEW LITERATURE**

GAS, 198 S. Alvarado St., Los Angeles 57, Calif.

8/55 Fill in numbers of items in which you are interested.

No. ..... No. ..... No. ..... No. .....

No. ..... No. ..... No. ..... No. .....

NAME AND TITLE .....

FIRM'S NAME .....

ADDRESS .....

CITY ..... ZONE ..... STATE .....

new products • *Cont'd.*

A wall-mounted thermostat with low voltage operation regulates the automatic operation of the ET. The control can be set to operate from high fire to off or from high fire to low bypass flame, depending on the need.

A-P Controls Corp.

■

5 Valve Box Locator

The new valve box locator by Aqua Survey & Instrument Co. locates valve and curb boxes quickly and accurately.

Ground cover—overgrown grass, concrete walks, fill-ins, slides, heavy ice or snow—does not interfere with the performance of the Aqua valve box locator.

The new unit has the exclusive Aqua electric braking, which eliminates "needle nervousness" and speeds up the locating process. It is equipped with a shoulder strap, which allows reading to be taken quickly from the normal standing position. Each unit is factory adjusted to the geographical location in which it will be used.

Aqua Survey & Instrument Co.

■

6 Ditcher

As a supplementary machine to a fleet of larger ditchers, Barber-Greene's new Model 702 ditcher can dig the size trench needed for house services.

Model 702 can be equipped with either of two digging booms. One 30 in. deep can be equipped with either a 2¼-in. or 4½-in. bucket line. The other, digging 40 in. deep, can be equipped with 2½-in. or 5-in. lines.

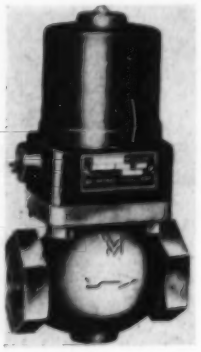
Especially useful to utilities, the angled construction of the ditcher's boom lets the operator dig under sidewalks and right up to house foundations, minimizing the amount of hand work on the trench.

Portability both on the job and from job to job is another feature of Model 702.

Barber-Greene Co.

■

7 Solenoid Valve



Utilization of line pressure to assist the solenoid in opening and closing the valve is featured in a new type of packless solenoid valve introduced by Magnatrol Valve Corp. Designed for normally closed operation, the Type S valve provides a full port equal to the nominal pipe size opening. The valve may be used to control automatically or from remote points.

An auxiliary operating piston, which is integral with the disc holder, assists the solenoid in opening the valve against higher line pressures. The solenoid coil has class H insulation for continuous duty, high-heat service. Valve return spring is also heat resistant.

Magnatrol Valve Corp.

■

8 Flow Transmitter

Designated the 13A d/p cell transmitter, Foxboro Co.'s new force balance flow transmitter measures differential pressures and transmits a 3-15 psi signal to a receiving, recording, or controlling instrument.

Unitized "block" construction of the body, transmitter, and air relay eliminates effects of piping stresses. Operating on the force balance principle, the all-metal measuring components and temperature-stable parts maintain calibrated accuracy over a wide range of ambient conditions.

A silicone-filled capsule, with two pressure-sensing stainless steel diaphragms, automatically dampens and filters flow "noises" at the measurement source, yet permits high speed response to actual flow.

Foxboro Co.

■

9 Plastic Lead Seal

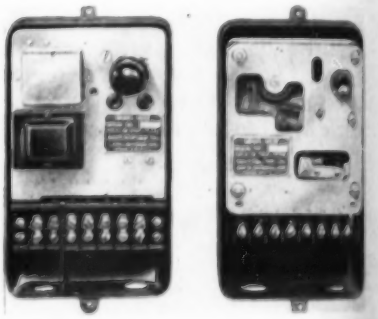
A new plastic lead seal polyvinyl tube provides an easy and convenient method for applying the compound to threaded connections and other surfaces to eliminate waste or mess.

Tube is made from tough polyvinyl plastic that will not crack at the seams or separate at the bottom crimp. It will withstand constant squeezing and will not split or damage under the impact of falling blunt tools or similar objects.

Plastic lead seal pipe thread compound provides a permanent, leakproof seal under a wide variety of applications and service conditions—yet is non-hardening, thus permitting easy disassembly of connections, even after years of service. It withstands pressures up to 6000 psi, temperatures to 600° F and is insoluble in water, steam, gas, refrigerants, many chemicals and all petroleum products.

Crane Packing Co.

■



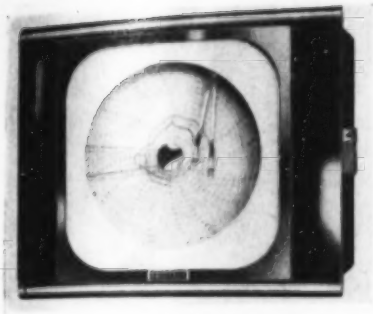
10 Combustion Safeguard

The new Twin Flame combustion safeguard system made by Control Engineering Corp. is specifically designed for gas-fired industrial equipment.

The effective utilization of constant impinging flames to complete an electrical path in a voltage responsive system has eliminated flame rods and photocells completely. Separate programmer and flame detector units provide economical, positive, and continuous flame supervision by flame itself. Multiple burner installations are also feasible.

Simplicity of Twin Flame design offers ease of adaptation to industrial gas burners and pilots. The loss of production time and materials are reduced to a minimum through the elimination of a high percentage of false shutdowns.

Safety Equipment Div.
Control Engineering Corp.



11 Potentiometer Recorder

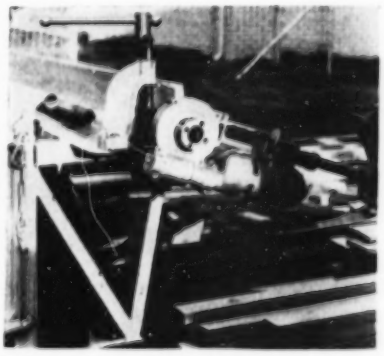
A new round-chart electronic Dynamaster potentiometer recorder that can make two continuous records at the same time on a 12-in. round chart has been announced by the Bristol Co.

Specific applications where two simultaneous continuous records are helpful include the taking of wet and dry resistance bulb temperatures for humidity measurements, Btu and temperature differential measurements, and speed of rotation from two different points on a paper machine.

The Dynamaster potentiometer and bridge instruments can be used to measure and control any variable which can be translated into an electrical quantity, such as temperature, pH, consistency, speed, pressure, weight, and others.

Bristol Co.

■



12 Power Pipe Threader

Quick and easy pipe threading on the job is now possible through the new Lawco Junior portable power pipe threader available from Velocity Power Tool Co.

Since the threader weighs only 20 lb and is only 27 in. in length, it is easily carried to where the threading is to be done. Likewise, it is designed and constructed for one-hand operation. It is equipped with a ¾-horsepower electric motor and a toggle switch to provide reversible power.

The tool may be used as an auger, for boring post holes, driving bolts and nuts, opening valves and as a hoist for weights up to 500 lb.

Velocity Power Tool Co.

GAS trade literature

13 Valve Bulletins

Ohio Injector Co. has released two new bulletins. (When ordering copies, use letter preceding description.)

a. Form 1006 describes OIC union bonnet bronze gate valve line with cutaway drawings and specifications.

b. Form 1005 covers the company's line of industrial iron body gate valves. Complete specifications are included.

Ohio Injector Co.

■

14 Furnace Bulletin

Modine Manufacturing Co. has issued a four-page bulletin that outlines uses of the new Modine gas-fired duct furnace in heating, ventilating, and air conditioning systems. The two-color catalog contains dimensional and performance data and drawings.

Modine Manufacturing Co.

■

15 Burner Bulletin

Specific burner dimensions and capacities for various pressures on Eclipse Walltite injector burners for high pressure gas are contained in a new bulletin (H-63T) from Eclipse Fuel Engineering Co.

Eclipse Fuel Engineering Co.

■

16 Chart Bulletin

Two catalogs are available from Bristol Co. (When ordering, use letter preceding description together with number of head.)

a. A 14-page, two-color bulletin outlines the methods and controls used in producing recording instrument charts.

b. Physical properties of Bristol's line of socket screw products are described in a new series of data sheets.

Bristol Co.

■

17 Vent Pipe Booklet

"Transite Gas Vent Pipe" is an illustrated 28-page booklet issued by Johns-Manville. This service manual on asbestos-cement pipe for venting domestic gas appliances presents essential data on diameters, lengths, weights, etc., in tabular form for quick reference. Installation recommendations are shown by close-up photographs and drawings.

Johns-Manville

18 Furnace Literature

The Airtemp division of Chrysler has published some new literature. (When ordering copies, use letter preceding description together with number of head.)

a. The company's up-to-date "Facts" booklet contains a number of quick-to-read notes on company history and management.

b. Gas-fired furnaces are the subject of another catalog listing complete model specifications and describing application of Airtemp's new "V" type furnace cooling coils.

Airtemp Div., Chrysler Corp.

■

19 Compressor Bulletin

Allis-Chalmers two-stage sliding vane type compressors for shop air, gas handling, drilling, and other applications are described in Bulletin 16B-8244. In addition to a table of ratings for the compressor, the bulletin carries a table of outline dimensions for the units.

Allis-Chalmers Manufacturing Co.

■

20 Plug Valve Booklet

Reference Booklet 39-5, a 28-page catalog from Homestead Valve Manufacturing Co., shows straightway, three-way, four-way, and multiple-port lubricated plug valves for 250-lb water-gas and 150-lb steam working pressures. The valves are illustrated and complete specifications are presented.

Homestead Valve Manufacturing Co.

■

21 Valve Bulletin

Complete description of a new low pressure gas solenoid valve is contained in Automatic Switch Co.'s technical bulletin 743. Flow in gallons per hour is shown in easy-to-read charts. Actual flow diagrams, in color, are also used to describe the new solenoid valve.

Automatic Switch Co.

■

22 Air Compressor Leaflet

"On the Spot . . . Air Power Package" is the title of a new eight-page, two-color flier (Form 2302) released by Ingersoll-Rand describing the 3R-36 cfm self-contained Spot Air portable compressor. It also deals with the many tools it will operate. Actual on-the-job illustrations are used.

Ingersoll-Rand Co.

Drop-in
SMOOTH SLIP-FIT
NEW
SLOT-PORT
COMBINATION
SMOOTH SLIP-FIT
ALLTROL
CENTER SIMMER
ANOTHER NEW DEVELOPMENT FOR THE ADVANCEMENT
OF THE GAS INDUSTRY

NEW top burner design! Center Simmer Button

MAKERS OF FAMOUS ALLTROL® CENTER SIMMER BURNERS DEVELOP BURNER DESIGN WITH THREADLESS ASSEMBLY

- **Easier to remove, clean and replace**
- **Wider range of efficient operation with *all* gases**
- **More stable turndown characteristics on low heats . . . ideal for LP-gas**

Here's new, smarter burner appearance . . . and a brand new feature to dramatize on the sales floor for greater-than-ever selling. Just *lift* burner cap off! The new precision engineered "drop-in" Center Simmer button slides in and out easily, instantly . . . holds the burner head firmly in place along three concentric ring surfaces by gravity. Always in proper alignment—removed or replaced effortlessly—in seconds!

Special slot-port combination in burner cap provides wider range of efficient operation on all gases . . . more stable turndown to all low heats, especially on LP-gas . . . greater capacity for higher input ratings.

Housewives' reluctance to clean burners is overcome with this new easy-to- remove burner. The smooth, polished aluminum surface washes as quickly and easily as a china cup. And the burner goes back in place in a jiffy. It's a *real* demonstration sales point that can help move your ranges faster.

RANGE MANUFACTURERS: **There's no assembly operation for you; burner caps and Center Simmer buttons are furnished in sets, packed in boxes with protective filler. There's dramatic, sparkling customer appeal when the dealer drops the bright and beautiful burners in place!**

HARPER-WYMAN COMPANY

ORIGINATORS OF CENTER SIMMER BURNERS

DEPT. H85-G • 8562 VINCENNES AVENUE • CHICAGO 20, ILLINOIS

GAS news

Plastic recommendations adopted by AGA committee

Two recommendations prepared by a special committee of the thermoplastic pipe division of the Society of the Plastic Industry have been approved by the AGA plastic pipe standards subcommittee and the distribution committee. The recommendations are printed below.

The reinforced plastic committee of SPI has been asked to prepare similar recommendations applicable to reinforced plastic pipe, according to the AGA subcommittee's report presented at the April distribution conference.

Considerable discussion was had on the desirability and details of a test for resistance of plastic pipe to impact, such as might be caused by dropping the pipe, or dropping materials on the pipe. A test method developed by one of the member gas companies was considered to be basically applicable, but it appeared necessary to decide on details such as of temperature range, size and shape of striking head, force of impact, etc. The SPI and gas industry members agreed to give this matter further study.

The matter of resistance of plastic materials to manufactured gas drip liquids was again reviewed, and the following resolution was adopted: "The subcommittee on plastic pipe standards wishes to reiterate its conclusion that the materials used to produce thermoplastic pipe for gas industry use underground are subject to attack by aromatic hydrocarbons. Therefore, the subcommittee cannot recommend the use of such pipe for the distribution of manufactured gas until further research and tests have been completed."

John Fugazzi, Public Service Co. of Colorado, has succeeded Guy Corfield, Southern California Gas Co., as chairman of the AGA subcommittee on plastic pipe standards.

RECOMMENDATION NO. 1

Working Stress for Various Plastic Materials

For use at 100° F. To be applied in Barlow's or Lame's Formula.

Normal Impact PVC—Type I (Marvinol NR-7045 or NR-7020, Exon 1410 or Geon 8750)	1200 psi
High Impact PVC—Type II (Marvinol RX-234-13 or RX-234-23, or Geon 8700A or 8700)	1000 psi
Styrene-Acrylonitrile Resin Rubber Blend (B or B-E Grade)	1000 psi
Butyrate (formulas MH Flow—435, 205 and 460 in clear or black—265 in black)	700 psi

RECOMMENDATION NO. 2

Minimum Wall Thickness for Various Types of Plastic Pipe

For Gas Distribution at Pressures Not Exceeding 60 psi and Temperatures up to 100° F

For Pull Through Service in Existing Metal Lines

Nominal Size	O.D.	Wall Thickness
½	.625	All sizes in all materials to have a wall thickness .062 except 1¼ in. Butyrate will be .080.
¾	.875	
1	1.125	
1¼	1.375	
1¾	1.875	

Note: Butyrate pipe may be coiled in this application if desired. Other materials should be furnished in straight lengths only.

FOR NEW SERVICES AND MAINS

Nominal Size	IPS O.D.	Styrene Acrylonitrile and High Impact PVC (Type 2)	Normal Impact PVC (Type 1)	Cellulose Acetate Butyrate
½	.840	.090	.090	.090
¾	1.050	.090	.090	.090
1	1.315	.090	.090	.090
1¼	1.660	.090	.090	.090
1½	1.900	.090	.090	.090
2	2.375	.090	.090	110
2½	2.875	.110	.100	.135
3	3.500	.125	.120	.160
4	4.500	.155	.145	.205
5	5.563	.190	.170	.250
6	6.625	.220	.200	.300

Strict state control of underground storage voted

Strict state regulation of underground gas storage near coal mines has been voted by the Pennsylvania house. The house sent to the senate, without debate, a proposal carrying the joint support of gas and coal interests and the United Mine Workers.

The bill would require a state permit before a person can drill a well through a workable coal seam; direct coal and gas storage operators to file maps showing boundaries of their operations; grant limited power of eminent domain to gas utilities and storage operators for aquiring rights to store gas; establish storage operators responsible for the prevention of escape of stored gas into coal mines; fix uniform regulations for the drilling and plugging of wells.

Job security book published by NAM

Calling for bold and ingenious action by management to provide a steadier work and pay for industrial employees, the National Association of Manufacturers has published a new study entitled "Toward Steadier Work and Pay," which has been designed to assist employers in achieving greater job security—through time-tested techniques.

In addition to giving practical advice in setting up job stabilization programs, the NAM booklet provides helpful information on the actual dollar-and-cents savings that are possible through employment regularization. The booklet explains how steady jobs cut employment compensation costs, overhead costs, and maintenance costs, and increases efficiency, productivity, and morale.

Gas ranges now available in 16 color choices

You can now buy a gas range in any one of 16 colors—from pink to stainless steel—from 19 manufacturers, and the AGA has published a chart show-

Outstanding quality

When you see one of these beautiful White-Rodgers Room Thermostats on the wall of a new home ...you have found a builder who knows and appreciates quality...and insists on it.

Why don't you?

There are many unusual features about White-Rodgers Room Thermostats besides their beauty—too many to describe here. To know them all, write today for literature that gives complete information.

WHITE-RODGERS
Controls FOR HEATING · REFRIGERATION AND AIR CONDITIONING

ST. LOUIS 6, MO.
TORONTO 8, ONTARIO

No matter how well built the air conditioning or refrigeration equipment you install...if its performance depends on automatic controls...it can be no better than the controls with which it is equipped.

CUT COSTS
ON UNDERGROUND
PIPING JOBS

...with a GREENLEE PIPE PUSHER

Installing pipe underground is quick and simple this way. With a GREENLEE Hydraulic Pipe Pusher *one man* pushes pipe through the ground—under streets, railways, walks, lawns, floors. Saves time, cuts costs through elimination of extensive ditching as just a short trench accommodates the Pusher. No tearing up of pavement, lawns, floors . . . eliminates tunneling, back-filling, tamping, repaving. Cuts job time to a fraction. Pusher often pays for itself through timesavings on first job or two.

No. 790 GREENLEE PUSHER For 3/4 to 4-inch pipe. Six speeds—5,600 to 40,000 lbs. pushing pressure.

No. 795 GREENLEE PUSHER For pipe larger than 4-inch, concrete sewer pipe, large drainage ducts. Six speeds—25,000 to 150,000 lbs. pushing pressure.

POWER PUMP For both sizes of GREENLEE Pushers. Pushes pipe at rate of two feet per minute.

GREENLEE

Get facts on timesaving Greenlee tools now. Write Greenlee Tool Co., Division of Greenlee Bros. & Co., 1948 Columbia Avenue, Rockford, Illinois, U.S.A.

ing the colors and the manufacturers.

This color chart is a supplement to the 1955 edition of the AGA's "Special Features of Current Gas Ranges," which lists recent gas range developments being produced by 40 manufacturers.

Eight categories are used: type, size, color other than white, top section, broiler section, oven section, recessed range sections, and additional features.

Gas-lit street feature of West Coast's Disneyland

When, on Oct. 18, delegates to the AGA-PCGA conventions gather at Disneyland, the fantastic new West coast entertainment center in Orange county, near Los Angeles, they will be witnessing not only a new concept in family amusement but also a picture of the growth of their own industry.

One of the first sights greeting the delegates when they enter Disneyland will be Main Street, U.S.A., a recreation of American small-town life in the gas-lit era of the turn of the century.

The gas lamps illuminating Disneyland's Main Street will be lit each evening by an old-fashioned lamplighter, just as they were in those bygone days.

Dozens of restaurants, sandwich counters and specialty houses will offer food to the throngs of visitors; and quiet, hardworking gas will be used predominantly in its preparation.

Two unique restaurants fronting on the hub of Disneyland will rely on gas for cooking, space heating and water heating.

Perhaps the most unusual role for gas at Disneyland is its use in conjunction with a scaled down version of an old-time freight train, which will take passengers on rides around the grounds of Disneyland. The train will be diesel-powered and gas will be used every morning to fire the engines for the day's runs.

Appalachian short course to feature D. A. Hulcy

D. A. Hulcy, president of Lone Star Gas Co., Dallas, will present the principal address at the Appalachian Gas Measurement Short Course scheduled for Aug. 20-31 at West Virginia University, Morgantown, W. Va.

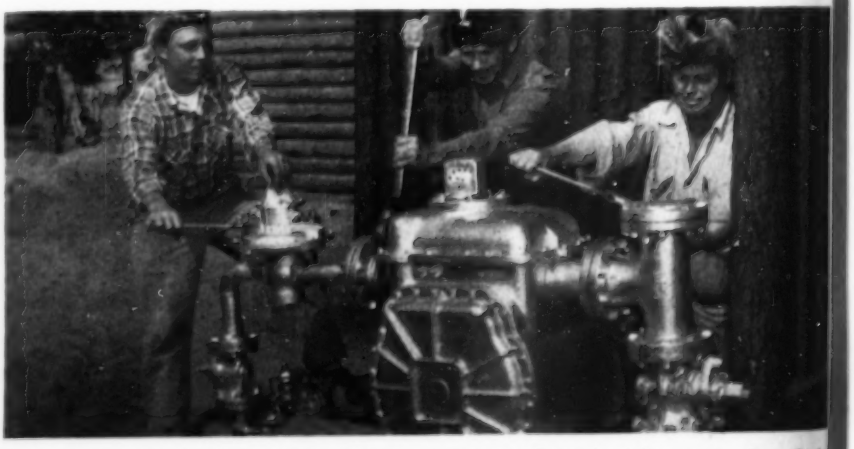
Thomas R. Weymouth, retired vice president of the Columbia Gas System and the originator of the orifice with flange taps, will be the other featured speaker on the opening session.

The purpose of the course is to provide information on application, operation and repair of natural gas quantity measurement and pressure regulation equipment. The latest developments of this equipment will be exhibited by 42 of the nation's leading gas equipment manufacturers.

For further information regarding the complete curriculum, registration, and dormitory or hotel accommodations, contact Professor R. E. Hanna of the university faculty at Morgantown.

Pipeline locators save damage claims

Additional uses of pipeline locators as insurance against damage to subsurface structures have been pointed out by Van H. Wilkinson, head of Wilkinson Products Co., Pasadena, Calif., following two recent coaxial cable breaks which interrupted television and radio service in the three Pacific Coast states of California, Oregon, and Washington.



Getting into spirit of things while installing gas meter at Disneyland by wearing Davy Crockett caps are three members of Southern Counties Gas Co. service crew. They are (left to right) Jerry Twellman, Dave Davenport, and Lead Mechanic Claude Harper. Gas not only will fuel lamps along "Main Street, U.S.A.," but will be used predominantly in Disneyland restaurants for cooking, water heating, and space heating.

Presenting **the New**

CRISE

Solenoid Gas Valve

Higher Capacity

The Crise Solenoid Gas Valve has been designed to combine performance, ruggedness and simplicity for long, trouble-free service on all types of gas fired heating equipment. A soft seat is accurately centered by an improved design to assure positive shut-off and quiet operation. Corrosion-resistant parts make the Crise SV-100 and SV-110 suitable for use with all types of gases. Available in ½" and ¾" sizes, 24 V or 115 V and with or without a manual opener. Write for bulletin.

A Host of Features

- **High Capacity**
- **Soft Seat Construction**
- **Quiet Operation**
- **Streamlined Design**
- **Positive Shut-off**
- **Corrosion Resistant**
- **Suitable For All Gases**

CRISE CONTROLS DIVISION

ACRO MANUFACTURING COMPANY

COLUMBUS 16, OHIO

Distributed in Canada by Leland Electric Canada, Ltd., Guelph, Ontario

VIBRA PAK

Standard Magnesium VIBRA-PAK ANODES *are uniformly packed which permits evenly distributed electrolytic action over the whole surface of the anode.*

This even distribution means longer lasting, higher operating efficiency. Gives added protection against corrosion loss.

Next time specify VIBRA-PAK.

*PAT. APPLIED FOR

If you are faced with a corrosion problem, let our engineers help you solve it. There's no obligation, of course. Wire, write or phone today.

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In one instance, a ditch digger sank its claws into CBS' coaxial cable in Hollywood during a "live" broadcast of a Bob Crosby show, causing $15,000 damage and depriving viewers of the rest of the show.

In the second case, the Pacific Northwest had most of its network television and radio cut off when the coaxial cable to California was damaged at Medford, Ore. Knocked out at the same time were press association teletype services. Pacific Telephone people said a contractor installing a water main cut through the cable and deprived the entire states of Washington and Oregon of their regular network television and radio programs.

Such damage could have been avoided, in the opinion of Mr. Wilkinson. Underground structures are usually mapped, and while maps may be inaccurate, modern electronic locating instruments will instantly and definitely reveal any such structure.

Insurance companies are becoming increasingly concerned with the frequency of such accidents across the nation, and are investigating the pipeline locators now on the market with a view towards making them required equipment for any contractors engaged in work which might endanger underground installations, Mr. Wilkinson said.

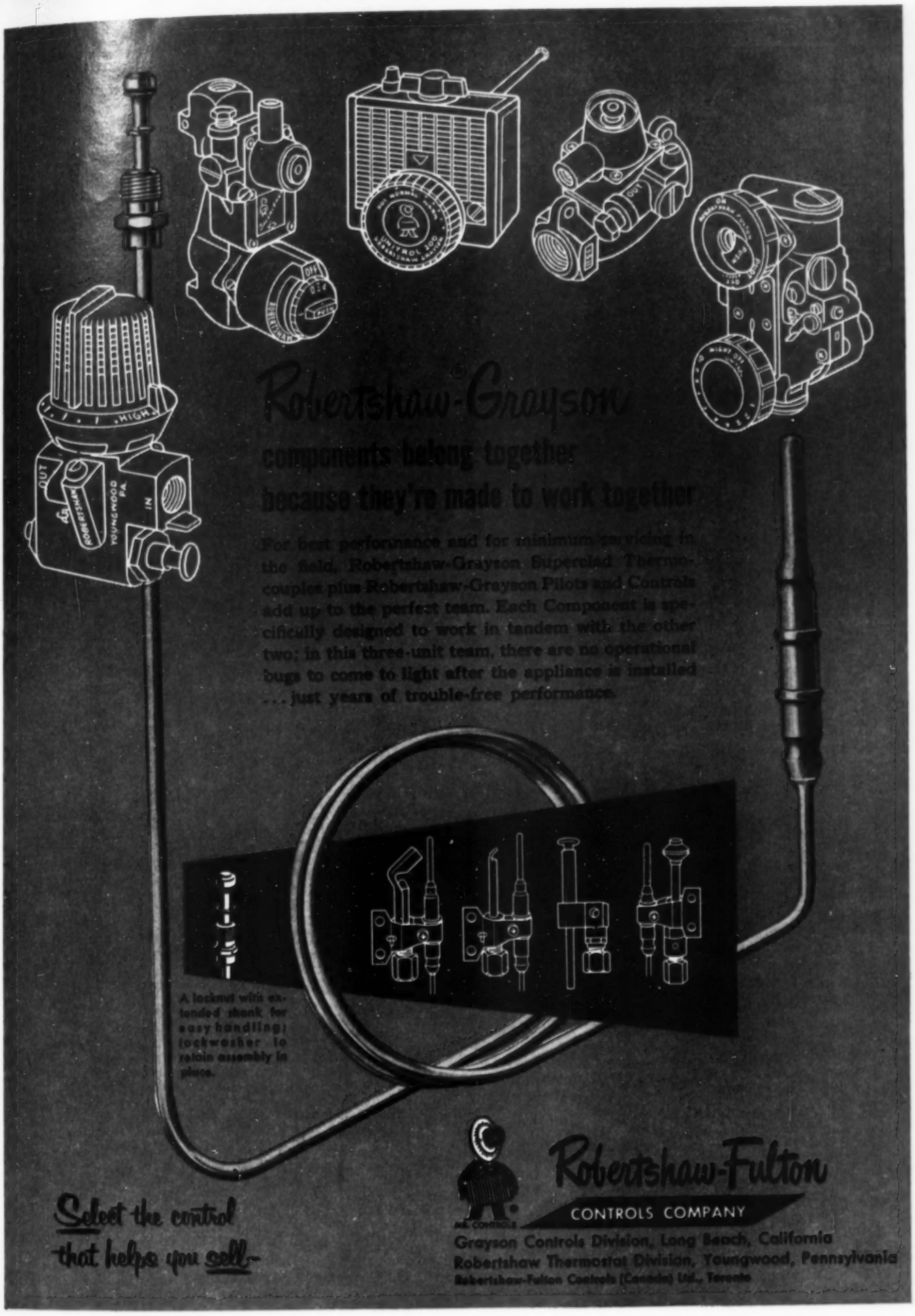
Kitchen remodeling contest scheduled by McCall's

More than 140 appliance and household equipment manufacturers will participate in *McCall's* $30,000 kitchen and laundry remodeling contest, scheduled to kick off with the magazine's September issue, and run through December.

Literature to help guide contestants in creating plans for remodeling their kitchens and laundries will be supplied by participating manufacturers. The contest seeks to make American families aware of existing inadequacies in their present kitchens and laundries, and stimulate them to do something about it.

A record number of utility companies are expected to tie in with *McCall's* for the contest. Many of the utility firms will conduct regional and local sub-contests of their own in conjunction with *McCall's* national run-off.

McCall's five-pronged promotion program calls for free sales displays, home service planning suggestions for use by the utility companies, advertising and publicity support, and local retail tie-in material, as well as the sub-contests conducted by utility firms.


Robertshaw-Grayson®
components belong together
because they're made to work together
For best performance and for minimum servicing in the field, Robertshaw-Grayson Superclad Thermocouples plus Robertshaw-Grayson Pilots and Controls add up to the perfect team. Each Component is specifically designed to work in tandem with the other two; in this three-unit team, there are no operational bugs to come to light after the appliance is installed ... just years of trouble-free performance.
A locknut with extended shank for easy handling; lockwasher to retain assembly in place.
Select the control that helps you sell-
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CONTROLS COMPANY
Grayson Controls Division, Long Beach, California
Robertshaw Thermostat Division, Youngwood, Pennsylvania
Robertshaw-Fulton Controls (Canada) Ltd., Toronto

Dealers, consumers divided over color in appliances

Appliance dealers and consumers are sharply divided over acceptance of color in major kitchen appliances, according to two surveys reported in the summer issue of McCall's *Appliance Retailing*.

Although in a pilot study of McCall's readers 52.2% of the consumers replying said they would buy color appliances, only 25% of the dealers polled by *Appliance Retailing* were enthusiastic about adding color models to their appliance lines.

The dealer survey revealed three major reasons for retailer opposition: a variety of color appliances will create inventory problems; a shade-matching problem will develop when the consumer desires one type of appliance from one manufacturer, and another of a different brand; and the higher price tag on color appliances makes retailers balky.

Only 40.2% of the consumers saying they would buy color appliances want the entire appliance in color.; 37.0% favor colored exteriors and white interiors; 23.8% want the appliance interior in color and the exterior in white; and another 13.2% of those favoring color expressed the desire for color in trim only.

Only 32.6% of the homemakers polled voted an outright "no" to color. An additional 14.6% said "no," but qualified their answers, many of them saying they prefer white for the time being.

Gas sponsors facsimile demonstration

The first investigation into the use of facsimile as a part of a major gas pipeline company's operations was made during the first week in August over the Texas Illinois Natural Gas Pipeline Co. microwave system between Houston and Chicago.

The test was sponsored by *GAS* magazine in an effort to broaden the gas industry's already extensive background in the field of pipeline communications. In addition to the pipeline company, those cooperating in the tests include Motorola Communications and Electronics, manufacturer of the company's existing microwave system, and Acme Telectronix Division of NEA Service Inc., manufacturer of facsimile equipment.

In an effort to simulate actual operating conditions facsimile equipment was located at the company's main office and dispatching center in Chicago, the company's district office in Houston and at one of the company's compressor stations. A wide selection of operating information such as correspondence, charts, sketches, logs, records and similar graphic material was transmitted among the three points.

A complete and exclusive report on the tests along with samples of the transmitted material will be published in the September issue of *GAS*.

Hartford Gas launches merchandising program

Two changes in merchandising policies of the Hartford (Conn.) Gas Co. have already affected the sale of gas heating equipment.

Chief features of the new program are a rental-purchase plan for gas heating equipment, a guaranteed fuel bill, money-back guarantee on the purchase of heating equipment, and a very liberal trade-in allowance for old heating equipment.

Customers have their choice of two no-risk money-back plans:

need help solving **CORROSION PROBLEMS?**

That's our business — corrosion control, writing specifications, running surveys, designing and installing cathodic protection systems of all types . . . a *complete* turn-key job.

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ANODE SPECIALISTS
AN-SPEC
HIGH QUALITY ANODES

PIPE LINE ANODE CORPORATION

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Pipeline Supply Co.
912 West 11th
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Boost Summer Sendout with Servel "add-on" gas-fired cooling units!

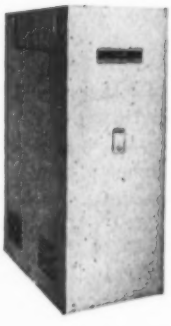
Summer's dog-days are here . . . in full force. And that means you have a ready-made supply of customers to solve your low-load problems.

Your present forced-air heating customers are good prospects for Servel gas-fired "add-on" cooling units. They'll really be interested when they see how easily, how inexpensively, this unit can be attached to their present system.

With Servel "add-on" units on your lines, *you'll* benefit, too. Sendout tends to equalize through the year. And your profits will go up, without increasing your winter peak or capital investment.

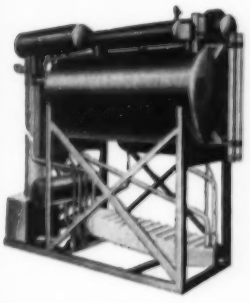
Take advantage of the huge demand for cool, comfortable summer living. Push Servel "add-on" units on your lines. Write for sure-fire promotion plans. SERVEL, INC., Dept. G-85, Evansville 20, Indiana.

Push Servel for bigger, better summer profits



Servel *All-Year*® air conditioners

Owners of these 2-, 3-, and 5-ton models are year-round customers. Servel **All-Year** units cool in summer, heat in winter . . . help take "seasons" out of supplying gas.



Servel water chillers

help commercial plants and institutions three ways. Provide customers with controlled chilled water for air conditioning, industrial cooling, and process cooling. Provide you with a steady, important volume load at profitable rates.

Servel

the name to watch for great advances in

AIR CONDITIONING ✓ REFRIGERATION

1. Rent a gas conversion burner for $2.95 a month installed. At any time during the first 24 months, the customer can buy the burner with full credit for all rental payments made, and three-year terms on the balance. If at the end of 24 months the customer does not wish to buy the burner, the company will remove it at no cost or obligation.
2. Buy a gas conversion burner for $285 installed with a $50 allowance for old heating equipment. Payment terms are available up to five years.

Coupled with this plan is a guaranteed bill program, whereby if the heating cost for the first full heating season exceeds a company estimate by more than 10%, Hartford Gas will refund the excess and remove the gas burner.

4th management workshop held at Columbia

How an executive development program was established at Central Hudson Gas & Electric Corp. was reviewed by the company president, Ernest R. Acker, at Columbia University's 4th annual Utility Management Workshop, which is devoted to the problems of developing executive leadership in the utility and public service industries.

Mr. Acker told how an outside consulting firm conducted a survey that showed "the company needed, first, training in supervisory techniques; second, clarification of relationships, duties, responsibilities, and authority within the organization; and, third, modernization of communications practice . . ."

Within the broad subject selected as the framework of the workshop—this year it was "Executive Development and Human Relationship"—each of three groups at the workshop selected and developed some aspects of the main subject, reporting its findings and conclusions at the end of the two-week program. The five questions posed and studied were: (1) Why is it desirable

BETTER
BEST
When it comes to the diaphragm data in your meter service records, you'll see better over-all accuracy and longer service life with Lancaster Groove Type Metal Rim Diaphragms in your meters.
From the groove type design which assures equal leather at both "in" and "out" stroke extremes . . . to the fine specially processed leather itself, Lancaster has the edge in practical engineering, quality materials and precision workmanship.
Send for a sample and see for yourself
METER PARTS CO.

Mr. William W. Clark,
Editorial Director
Jenkins Publications Inc.
198 S. Alvarado St.
Los Angeles 57, California

Dear Mr. Clark:

You column "Thermally Thinking" in *GAS* for June 1955 came to my attention the other day.

I enjoyed reading it very much; I appreciate the attention you gave the association and me in it; and I benefited from my reading of it.

It was very interesting to me at this time, Mr. Clark, because my very background in the distributive area long since served to teach me the importance of practical research, engineering, production, accounting and financial phases of industry. And by that I mean any industry, including gas.

However, it has been my experience over the years that the above phases by their very importance are well recognized and competently administered. The biggest problem in every industry today, and that includes our great gas industry, is *sales*.

A friend of mine, and doubtless yours, "Red" Motley, president of Parade Publications and an outstanding American, effectively preaches that "nothing happens until a sale is made." I agree with his philosophy, I believe you do, and hope that together we will be able to help convince this great industry of ours that all of its activities from research through finance should keep its thinking pointed toward and its activities geared to reaping the rewards that come from sales.

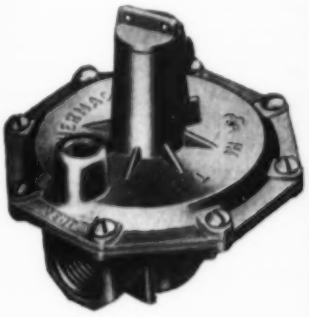
Thanks again, and all good wishes.

Most cordially,
C. S. Stackpole.

THERMAC
HM

GAS CONTROLS

SR-100 Combination Pressure Regulator and Thermo-Electric Safety Pilot. ⅜" and ½". Capacities up to 90280 B.T.U.



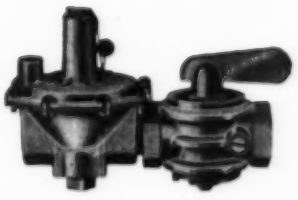
T-11 and T-15 Appliance Regulators. ½" and ¾". Capacities up to 284,000 B.T.U.

SR-200 Combination Pressure Regulator and Thermo-Electric Safety Pilot. ½" and ¾". Capacities up to 226,200 B.T.U.

Model TROD Pilot Regulator.

Aluminum Alloy Manual Main Gas Shut-off Valve. Free flow. ⅜", ½", ¾" and 1".

TR-34D-155, T-50, T-60 and T-70 Regulators. ¾" to 2½". Capacities up to 2,160,000 B.T.U.



Assembly of Thermac Gas Shut-off Valve and Appliance Regulator.

— finest controls on the market today

There's no substitute for dependability in a gas control for the proper operation of today's modern automatic appliances. Manufacturers for whom Thermac controls are engineered and built find the following design principles planned into each Thermac product:

1. Higher B.T.U. capacity, per size.
2. More compact. Easy and less expensive to install.
3. Fewer parts readily accessible without breaking line connections.
4. Dependable in performance and rugged to withstand years of hard service.
5. Finest materials and workmanship. Resistant to corrosion. Trouble free.

Examine any Thermac product thoroughly. Test it. Compare its performance, ease of adaptability, price and quality. Send for recommendations and samples. See how readily Thermac controls fit into your program.

Call Thermac first for immediate delivery.

THERMAC

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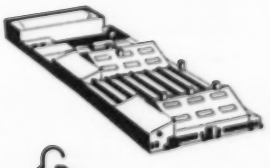
800 East 108th Street,
Los Angeles 59, California



"24 years experience building gas controls."

AGA

Certified by A.G.A.

to develop people? (2) Can you develop people? (3) If so, what do you expect to get, what do you actually get, and what does it cost? (4) Supposing you do not have a methodical training program—so what? (6) How do you develop people?

Prof. Robert Teviot Livingston, who conducts the workshop, believes that although answers to these problems will not be the solution to some great problems in human relations, the men will be aware of problems they in all likelihood did not know existed. With that awareness, they will be on the way to overcoming such problems in their own companies.

Participating in a small group discussion at Columbia University's Utility Management Workshop is Ernest A. Acker (at head of table), president, Central Hudson Gas & Electric Corp. At Mr. Acker's left is A. L. Colligan, director, personnel administration, Central Hudson.

National magazine to help appliance dealers

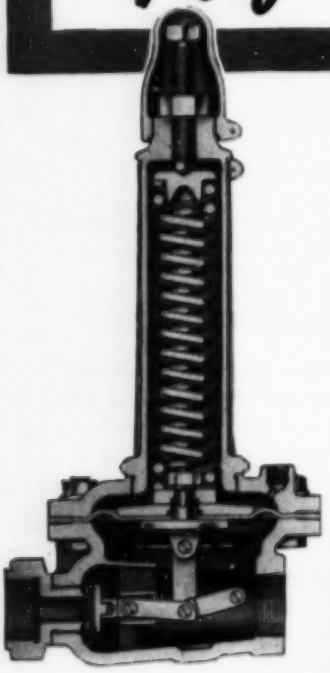
To help appliance dealers make the most of the late September-October selling season, *Look* magazine will sponsor a national appliance promotion built on the theme "Be a Better Cook . . . and Housekeeper, Too" and timed to break Sept. 26. This *Look*-sponsored event is designed to promote the sale of all kinds of home appliances.

Plans for the industry-wide promotion are well under way. The American Gas Association will alert its membership to the promotion and in all 40,000 brochures will soon be distributed to all interested elements in the appliance industry to apprise them of the upcoming promotion and describing the 28-piece display kits which *Look* will make available to all retailers tying in with the "Be a Better Cook . . . and Housekeeper, Too" promotion.

Pacific PR conference discusses conversion

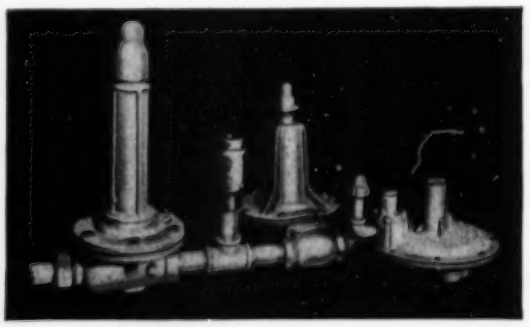
The arrival of natural gas in the Pacific Northwest next year will bring tremendous opportunities and also stern challenges, delegates to the Pacific Coast gas industry public relations conference in Seattle were informed. One hundred and sixty-four persons attended the workshop-type conference sponsored by PCGA, AGA, GAMA, INGAA, and the National Council for L. P. Gas Promotion.

IN THE HIGH PRESSURE FIELD
THERE IS SAFETY
IN *Reynolds...*



Accurate, Safe Control

of tremendous pressures is an ever present problem in the gas field. Reynolds field Regulator illustrated at left is one of the many high pressure regulators built by Reynolds. It is thoroughly tested and proved in service. It handles up to 1,000 pounds safely reducing same to pounds. For more than fifty-five years Reynolds has designed and built gas regulators. Safety, accurate performance, years of service—these are some of the built-in factors responsible for Reynolds enviable position in the Gas Control Field.



Reynolds Gas Regulator Co.
ANDERSON, INDIANA, U. S. A.
GAS CONTROL SINCE 1892

Profit by personalized selling tools!

Most complete selling literature lineup in the industry, to help you "be Mr. B" in your city. Personalized with *your name* and BRYANT sales message, of course.

be "Mr. B"

(AUTHORIZED BRYANT HOME COMFORT DEALER)

Only "Mr. B"—the Bryant Home Comfort Dealer—has *all 8* of these selling assets to build his business BIG:

1. A name customers know and want
2. The most complete line of automatic heating, air conditioning, water heating
3. Quality equipment for every market
4. Exceptional distributor service
5. Professional sales training
6. Personalized selling tools for you
7. National advertising featuring you
8. Co-op "Mr. B" ads for local papers

For bigger profits now, for a secure and prosperous future—see your Bryant Distributor. Ask him about Bryant's big "Mr. B" action program, and how it can make sales and money for you!

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AUTOMATIC HEATING
AIR CONDITIONING
WATER HEATING

CORROSION
ENGINEERS

Prominent engineering and construction firm with headquarters in New York has permanent positions open for graduate Electrical Engineers or equivalent.

Attractive starting salary with opportunity for advancement. Minimum 4 years experience in field testing and design of corrosion mitigating systems required. Must be willing to travel.

Submit resume of experience, education and personal data to:

Box 75, GAS,
198 S. Alvarado St.,
Los Angeles 57, Calif.

Participants in the panel discussion on maintaining good PR through servicing of heating equipment were from left: R. M. Brigham, Springfield Gas Light Co.; C. C. Westmoreland, Southern California Gas; Nathan H. Gellert Jr., Seattle Gas; Claude S. Hazel, Philadelphia Gas Works; W. L. Shomaker, Northern Natural.

The story of successful gas promotions in the heart of the TVA terrritory was told by S. V. O'Lenic, Chattanooga Gas Co. Conversion experiences of Springfield (Mass.) Gas Light Co. were detailed by Robert M. Brigham, assistant vice president. "Conversion presents a challenge to public relations people as well as to your various technical people," he remarked. "Everyone of your customers is to be inconvenienced to varying degrees . . ."

C. C. Westmoreland, Southern California Gas Co., urged that information about the gas industry get to the general public and administrative officials of city, county and state governments. He noted that city and county engineers, street and road superintendents, fire and health departments, usually welcome industry support and cooperation in teaching proper, safe handling of gas.

GAS news notes

Utah's Public Service Commission has granted authority to Loran I. Laughlin, Goodland, Kan. natural gas distributor, to provide natural gas service to Vernal, Moab, and Monticello. At the same time, the commission denied a certificate to Greeley (Colo.) Gas Co. to serve Vernal. The lateness of the filing of the Greeley application and the fact that Mr. Laughlin would serve all three Utah cities were reasons cited for granting his application.

The natural gas regulatory controversy was used last month as the topic of discussion on the opening program of a 12-week series of radio programs presented as a public service by the National Association of Manufacturers. Participants included W. M. Vaughey, president of the Independent Petroleum Association of American, and Dr. John W. Boatwright, Standard Oil Co., representing the American Petroleum Institute.

Northern Illinois Gas Co., Bellwood, has formally acquired ownership of the Union Gas & Electric Co., Bloomington and Normal, Ill., through an exchange of common stock, carrying out the terms of an agreement signed May 4 and authorized by the Illinois Commerce Commission. Under the agreement, Northern Illinois Gas exchanged 62,500 shares of the company's $5 par

Telsco. the tight-sealing
PRESSURE FITTING
that conducts electricity

Telsco Long and Short Couplings, Adapters, 90° Elbows, and Tees, ½ through 2 inches.

Use Telsco Fittings on Plastic Pipe, too—Metal Stiffeners for this application are available.

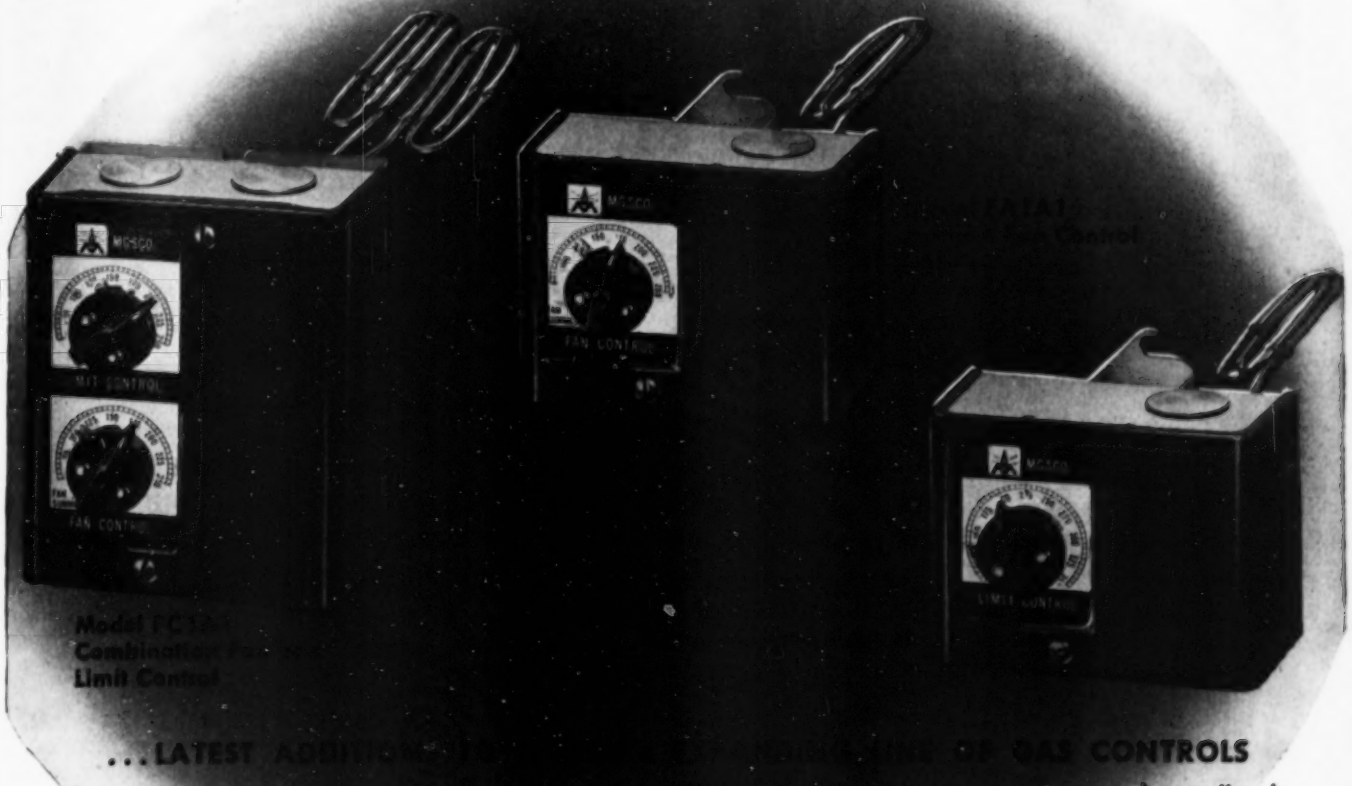
The unique sealing principle used in Telsco Threadless Fittings concentrates great pressure, under containment, on *all sides* of a *small* rubber gasket (See cross section). Under this tremendous pressure, confined in a small area, the gasket forms a tight seal against leaks.

At the factory every Telsco Fitting gets a 90-pound air pressure test, under water—assuring a sound casting every time.

Telsco Fittings do not insulate. Instead they conduct static electricity without the time, effort and cost of bonding every connection.

TELSCO FITTINGS DIVISION
5420 REDFIELD STREET DALLAS 19, TEXAS

A COMPLETE LINE OF FAN AND LIMIT CONTROLS FOR WARM AIR FURNACES...



...LATEST ADDITIONS TO MGSCO LINE OF GAS CONTROLS

Now you can order all your fan and limit requirements from one manufacturing source.

Note the outstanding plus values of these MGSCO fan and limit controls:

- **Accurate Operation** is provided by trouble-free liquid expansion power elements. Settings will not change over temperature range of the control.
- **Mounting Flexibility** . . . reliable operation even close to the heat exchanger without need for special precautions. May also be mounted in any position without affecting accuracy.
- **Compact** . . . flexible elements permit "tight-spot" location.
- **Resistance to Ambient Temperatures** due to "engineering" of elements.
- **Rugged Construction** . . . each unit enclosed in special enclosure.
- **Easy-to-Read Dial** . . . calibrated dial shows settings directly. Adjustable stops to change settings.

Use these reliable MGSCO fan and limit controls in your designs. They are a functional and sales asset to your line of gas products. These quality units require minimum attention in the field, a real time and money saver for you.

Consult with our engineers on your problem.

Why Not Order the Controls you Need from this Handy Table?

Model Number	Control	Cut-Out Setting		Cut-In Setting		Differential		Adjustable Stop	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
FA1A1	Furnace Fan Control	75	225	90	250	15	65	125	250
FB1A1	Warm Air Limit Control	120	350	100	350	20	65	200	350
FC1A1	Combination Furnace Fan Limit Control	50	225	65	250	15	65	80	250
		65	250	50	225	15	65	80	250

Control	A.C. Motor Ratings				A.C. Non-Inductive		Pilot Service	
	115 v.		230 v.					
	Full Load (Amp.)	Locked Rotor (Amp.)	Full Load (Amp.)	Locked Rotor (Amp.)	115 v. (Amps.)	230 v. (Amps.)	d.c. 115 or 230 v.	a.c. 115 or 230 v.
FA1A1 FB1A1 FC1A1	7.4	51	44.4	204	15.9	6.9	125 v.a.	57.5 v.a.

Write us for the Complete Specifications

MILWAUKEE GAS SPECIALTY CO., Dept. SC-2, Milwaukee 1, Wis.

Accessories
YOU'LL APPRECIATE!

Everyone has accessories, but as you can plainly see, there *is* a difference. Some take years to develop. Maxine's accessories are so different, SO DEVELOPED, as to make excellent CONVERSATION PIECES. They cannot be fully unveiled here, but for your PRIVATE STUDY, Maxine will send you an UNEXPURGATED version, complete with actual LIFE-LIKE PHOTOS. Suitable for PIN-UP wherever gas men congregate. No charge, not even postage.

- Molded Colons
- Vent Tube Connectors
- Fittings
- Limiting Devices
- Dust Caps
- Vent Screens

MAXITROL COMPANY
12200 BEECH ROAD
DETROIT 39, MICH.

Originators of "STRAIGHT-THRU-FLOW"

SOLD ON THE PACIFIC COAST BY PACIFIC SCIENTIFIC CO., SAN FRANCISCO • LOS ANGELES • SEATTLE • PORTLAND

Meet the latest expandable type of curb meter box, the Forni type P. A.

• *Write For Details and Samples*

GEORGE P. FORNI CO.
1379 62nd St., Emeryville, Calif. • OL. 2-7410

Also Manufactured Pre-Cast Regulator Pits and Sidewalk and Traffic Type Valve Boxes

Some of Its Outstanding Features:

1. Simplicity in design—three different pieces make any size unit.
2. Strong, rigid, construction —all pieces completey reinforced.
3. Tripping hazard eliminated because of recessed cover —box can be leveled to sidewalk grade without cover in place.
4. Meter sets kept cleaner—concrete bottom cast as an integral part of box sides.
5. Ample room in box to service meters or exchange for larger size meter.

common stock for the 6000 shares of $100 par common stock of Union Gas owned by William E. Vogelback, Chicago.

A gas transmission and distribution panel has been organized within the Military Petroleum Advisory Board, which has been increased from 24 to 27 members to expand gas industry representation. A. W. Lundstrum, president of Ohio Fuel Gas Co., Columbus, heads the panel. The other new members are Grove Lawrence, vice president, Southern California Gas Co., Los Angeles, and John F. Merriam, president, Northern Natural Gas Co., Omaha.

The board of directors of the Key Co., manufacturer of oil refinery, chemical plant, and power plant equipment, has approved an offer by ACF Industries Inc. to purchase its assets.

Ground has been broken for construction of a 104,000-sq ft parts plant in Russellville, Ky. for Rockwell Manufacturing Co. The new $1 million plant will turn out parts for all Rockwell products.

Sharples Chemicals Inc. was dissolved as a corporation last month and became an operating division of the Pennsylvania Salt Manufacturing Co., Philadelphia. Sharples, which operates plants in Wyandotte, Mich. and Houston, will continue to operate without change.

Robinson Orifice Fitting Co., Los Angeles, has acquired a new plant site for the Robinson Orifice Fitting Co. of Texas Inc. in the Houston Industrial District. The company will manufacture orifice fittings and meter runs for distribution in the Mid-continent and Gulf Coast territory.

American Stock Exchange listing is being sought by Sherman Products Inc., Royal Oak, Mich. The tractor-mounted industrial equipment producer and distributor has assets totaling nearly $2 million. Completion of the application and its acceptance by the exchange is expected by August or September.

Panellit Inc., Skokie, Ill., has formed a Canadian affiliate, Panellit of Canada Ltd., Toronto, Ontario. T. A. Hislop is chief engineer of the new facility, which will specialize in engineering, design and fabrication of industrial automatic control systems, graphic and control instrument panels, and information systems.

4 new extra values WITH American® Ironcase Meters

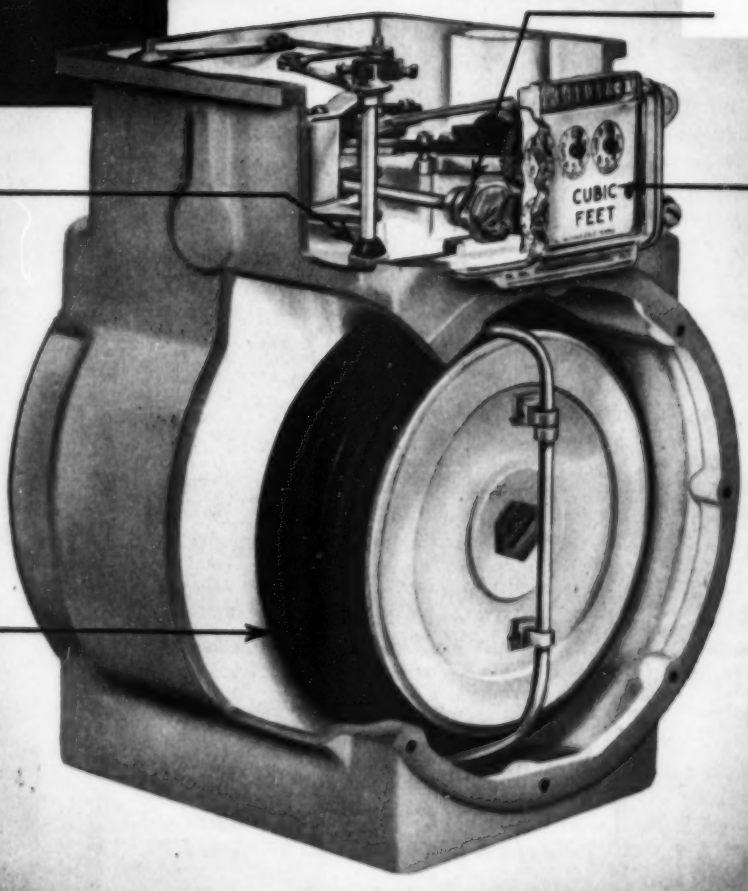
Year after year, *American*® meters cost you less to operate — assure you of maximum accuracy with least maintenance.

New flag rod and axle box grommet seals, now standard equipment in domestic Ironcase meters, are typical *extra values* developed through constant research for better materials, design and manufacturing methods.

For any application of metering equipment, you are sure of the best when you buy American, the only *complete line* of precision instruments to assure you of "sustained accuracy at lower cost."

NEW composition axle box grommet seals prevent leaks and reduce friction to a minimum . . . no measurable leakage after millions of cycles. Unique design provides greater sealing ability at increased pressures—with no sacrifice in friction.

NEW composition flag rod grommet seals provide uniform, minimum friction and assure dependable, positive leak protection . . . sealing ability unaffected in normal vapor service with natural, manufactured or LP gas.



NEW plastic Index Box is easier to read—equally suitable for exterior or interior meter settings. Molded in one piece, the new box is impact and shock resistant... unaffected by ordinary exposure to the elements. Standard on all 3B, 5B and 10B Ironcase and 5B/225 Aluminumcase Meters.

NEW molded Duramic diaphragms developed and produced by American for applications requiring a rugged, composition material . . . provide years of trouble-free service.

New Meter Connection Package— Greater convenience in identifying, handling and storing meter caps and swivels with American's new packaging. These parts are now packed in small unit cartons contained within a master carton, labeled for ready identification — replacing barrels formerly used.

AMERICAN METER COMPANY
INCORPORATED ESTABLISHED 1904

GENERAL SALES OFFICE: 1513 Race Street, Philadelphia
Albany • Alhambra • Atlanta • Baltimore • Birmingham
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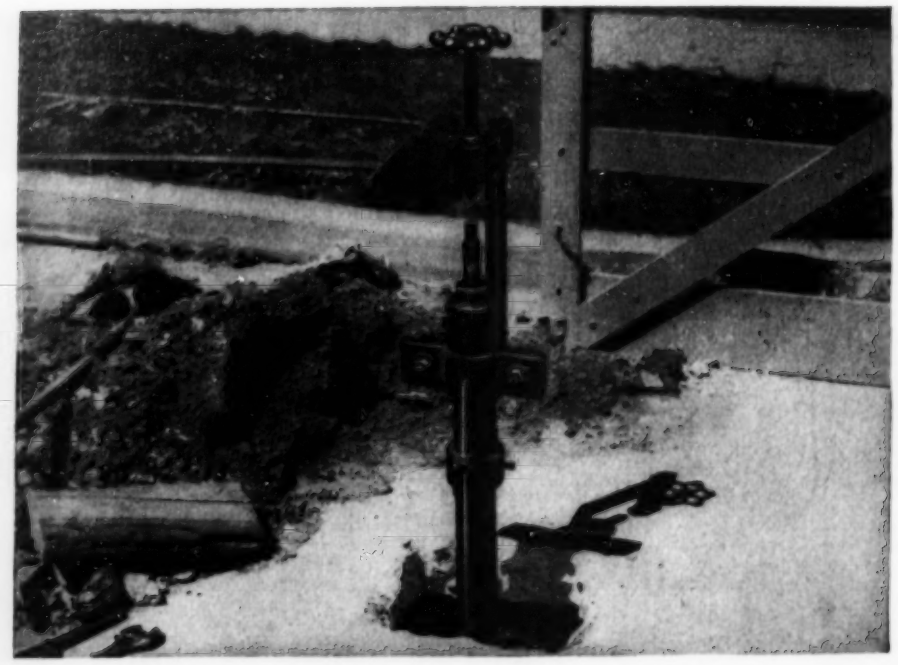
Kansas City • Los Angeles • Minneapolis • New York
Omaha • Pittsburgh • San Francisco • Seattle • Tulsa
IN CANADA: Canadian Meter Company, Limited, Hamilton
Edmonton • Calgary



Modern leak control

with CARBOSEAL *Anti-Leak*

Trade-Mark

The gas company that is using this modern main-tapping device (it works through street openings only 1 foot square) has chosen the *modern* method of stopping leakage due to dried-out fiber packing—CARBOSEAL Anti-Leak.

This progressive gas company knows that CARBOSEAL Anti-Leak is:

• effective • inexpensive • lasting • easy and economical to apply

Get all the facts. Write for the booklet, Form 4506—or the 16 mm. color-sound movie, "CARBOSEAL Anti-Leak Stops Gas-Main Leakage," which will be sent to you without charge.

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Malleable Iron Follower Glands
Strong — Corrosion Resistant — Light Weight — Sizes 2" thru 12"

High Strength Cast Iron Tee Head Bolts and Nuts

Write for Information and Prices to:

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Cadillac Malleable Iron Co.
Cadillac, Michigan

GAS associations

Canadian confidence expressed at convention

Some 400 delegates from seven Canadian provinces and several states of the U. S. were on hand to hear gas industry leaders express confidence in the future of the Canadian gas industry at the 48th annual convention of the Canadian Gas Association in Niagara Falls, Ont.

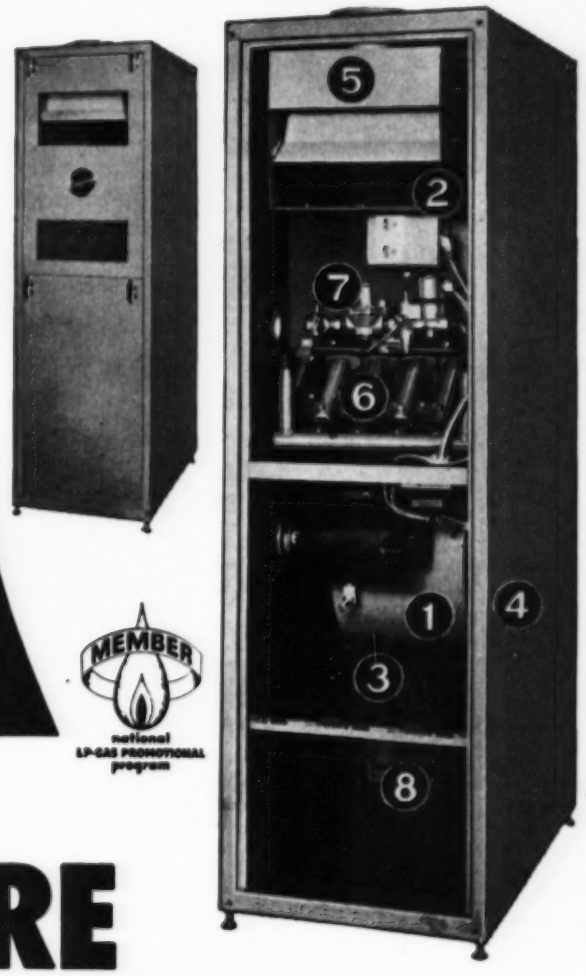
P. W. Geldard, Consumers' Gas Co. of Toronto, was elected president succeeding S. B. Severson, Dominion Natural Gas Co. Ltd. F. R. Palin, Union Gas Co. of Canada, was elected 1st vice president; H. L. Purdy, B. C. Electric, 2nd vice president, and W. A. Higgins was appointed secretary and treasurer.

Among speakers was T. T. Arden, GAMA president, who told delegates there are "vast and unsatisfied markets immediately ahead of us." The industry must have good management, product development, good sales, promotion and public relations programs to successfully tap this market. Only through engineering and technological research can proper product development be realized, he said.

"Natural Gas on the March" was the theme for a panel of industry leaders

Details of the Canadian Gas Association convention are discussed by P. W. Geldard (left), newly elected president of the group, and S. B. Severson, outgoing president.

the Inside Story



OF FASTER SALES!

There's NO DOUBT *about it!*

MEMBER national LP-GAS PROMOTIONAL program

EMPIRE

MAKES THE BEST *Gas* HEATING APPLIANCES IN THE WORLD

1. Empire's powerful blower is cradled in rubber for amazingly quiet operation.
2. The heat exchanger is engineered to eliminate expansion and contraction noise.
3. The over-size filter traps dust, dirt and pollen . . . helps keep your home shining clean!
4. Smart, durable steel cabinet has fused-enamel finish, is beautifully designed.
5. Vented to remove combustion wastes. Welded gas-tight. Draft diverter prevents down-drafts.
6. Empire's exclusive "Thriftmatic" Gas Burner delivers every penny's worth of heat from your fuel. Featuring the "stainless steel" ribbon type cast iron burners.
7. Automatic room temperature controls, necessary limit switches both blower and bonnet and automatic pilot (100% cut-off type) are standard equipment.
8. All controls, burners and heat exchangers are accessible from the front — Flues can be cleaned from front without any disconnections or dismantling.

EMPIRE

A Great Name in Gas Appliances

STOVE COMPANY

BELLEVILLE, ILLINOIS

SAVES $ LOTS OF $

$ . . . on pipe runs under streets, highways, pavement, gardens, etc.

$ $

REG. U. S. PAT. OFF.

HYDRAUGER*

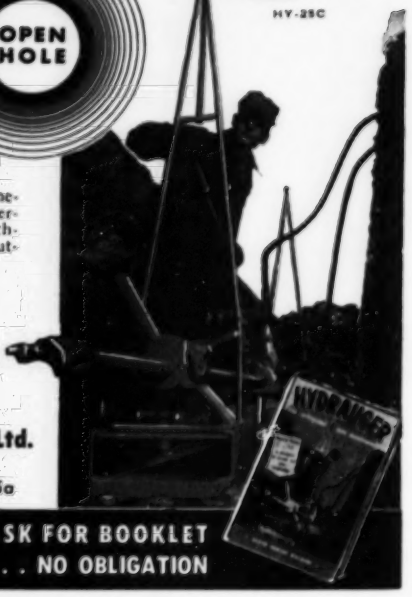
HY-25C

OPEN HOLE

AVOID TIME WASTE

Hydrauger is a modern, time-saving way to install underground pipe . . . avoids trenching, backfilling, pavement cutting, etc.

2" to 24" BITS and REAMERS



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681 Market Street
San Francisco, California

*Earth Boring Tool

ASK FOR BOOKLET . . . NO OBLIGATION

HERE'S WHAT SELLS HEATERS . . .

Expressly designed to provide greater warmth . . . more comfort. The easiest of all to clean . . . inside and out . . . Here's why: wide service door, entire lower back area fully open, top louver lifts out.

Exclusive directional louvers direct the heat at an angle into the room and away from the walls . . . affording better circulation . . . cleaner walls . . . Only Peerless has it.

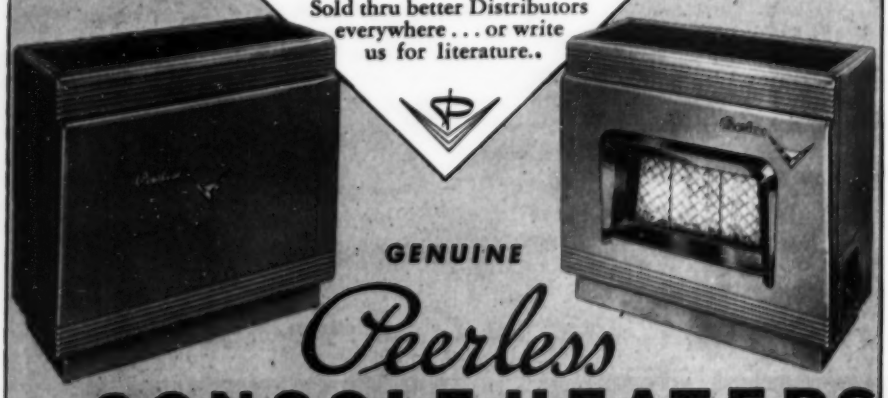
This advanced design will be good for many years . . . a feature the smart buyers demand.

There's greater economy . . . greater heating efficiency in a Peerless because it's built by heating specialists with over 70 years of know-how.

Top flight quality is evident at a glance . . . and still more so to the most discriminating that look at every minute detail.

These are only a few of the countless features that make Peerless the greatest heating value in today's market.

Sold thru better Distributors everywhere . . . or write us for literature..



GENUINE Peerless GAS CONSOLE HEATERS

PEERLESS MANUFACTURING CORPORATION, LOUISVILLE 10, KY.

associations • *Continued*

representing various parts of Canada. A. P. Craig, Trans-Canada Pipe Lines Ltd., discussed plans and prospects for the trans-Canada line and said western natural gas producers would launch a great exploration and development program once markets in the East were assured.

Other speakers included E. H. Rohrer, B. C. Electric, who said plans were developing for the introduction of natural gas to the Pacific area; B. F. Willson, Northwestern Utilities Ltd., who pointed out that expansion in Alberta has been evenly distributed over the main classifications; J. R. Sarsfield, Saskatchewan Power Corp., said high standards of installations were supported in Saskatchewan and that sales courses were offered to young employees of dealers; O. L. Jones, Consumers' Gas Co., who declared that acceptance of natural gas was all-important and that frankness and provision of all the facts was one way to influence the public favorably.

Harold E. Eckes, East Ohio Gas Co., Cleveland, outlined public relations techniques used in his firm and the methods of dealing with press, radio and TV representatives.

PAR activities and problems grew during 10-year history

During 1954 the PAR Plan of the gas industry completed its first decade of existence—10 full years of progress, James F. Oates Jr., chairman of the PAR committee, stated in the 1954 PAR Annual Report.

In his report, Mr. Oates said the past 10 years have seen a continuing growth of PAR activities, as well as a continuing growth of problems which must be solved to assure long-term profitability of the expanding gas utility and pipeline industry.

Financial support from utility and and pipeline companies has increased from an annual average of $1,552,000 for the first three years of the PAR program (1945-1947) to a record of $2,222,000 in 1954. A substantial part of the increase has been required to meet higher costs of conducting research and placing advertisements and has not been available to provide for a much needed expansion of the program.

A new and more flexible PAR subscription pattern, designed to obtain greater gas industry support was prepared by the 1954 PAR committee and adopted by the AGA board of directors. Early responses received in 1955 indicate substantial success in achieving an increase in PAR support in terms of

funds provided and the number of company subscribers.

Special notice was given in the report of two outstanding PAR developments. The first was the inauguration of an active and comprehensive research program under PAR to make possible more satisfactory and economical gas air conditioning. The second development was the inclusion, presently on a supplementary optional basis, of significant public information activities as part of the 1955 PAR plan.

Disneyland to be highlight of AGA-PCGA convention

Disneyland, the fabulous new West Coast entertainment center, will be the site of a gigantic western barbecue on Oct. 18 to which all delegates and guests attending the AGA-PCGA convention in Los Angeles are invited. The barbecue will be staged around campfires, with authentic cowboy singing adding color to the event. After the barbecue, the visitors will tour the four kingdoms comprising the fantastic empire that is Disneyland.

Among other features of the convention covered in the progress report made by sub-committees on arrangements was the report of Kurwin R. Boyes, secretary and convention manager of AGA, detailing preliminary plans of the various AGA sections.

The accounting section's sections will be held at the Hotel Statler. The chairman of the PCGA accounting section will greet delegates and participate in meetings on Oct. 17 and 18. Plans include presentation of the Order of Accounting Merit awards, a paper on electronic accounting, a customer relations panel, and discussions on taxes, mechanization, incentive compensation and cost management.

The residential gas section and the industrial and commercial gas section will sponsor a joint luncheon on Monday, Oct. 17. C. S. Stackpole, managing director of AGA, will welcome guests and a talk will be given on the PAR program and the Gas Industry Delevopment program.

On Tuesday afternoon the Residential Section will present a program devoted to sales problems of the industry and possible solutions. A new colored motion picture on New Freedom Gas Kitchen and Laundry sales will be shown. The president of GAMA will address the meeting and an executive of Servel Inc. will present the Servel gas refrigerator awards.

The industrial and commercial gas section, with Ray Trowbridge, Seattle Gas Co., as chairman, will present qualified speakers on timely subjects coverering both the industrial and commercial phases of the gas business.

Cleveland "80" uses long reach, accuracy, teams up with trencher on tough 10-mile job

ON A 10-INCH CAST IRON JOB in Loogootee, Ind. this winter, the contractor matched his Cleveland trencher and Cleveland Model 80 side crane against 10 miles of really rough work. He reports his decision paid off well in both time and money saved.

Cutting the 10-mile line through hilly terrain alongside a curving road, his Cleveland "140" maintained a fast, dependable pace overcoming frost and plenty of Indiana sandstone. Despite the tough digging in close quarters, the "140" left a clean trench ready for pipelaying.

The one-man-operated "80" kept the pipelaying operation up close, usually only a couple of joints behind the trencher. It picked up the pipe strung along the opposite side of the road, turned on its maneuverable full crawlers and accurately positioned the pipe for fast, easy installation. The Model 80's large, easy-acting hydraulic clutches and smooth handling brakes and boom hoist which placed and held pipe exactly to required positions also are responsible for its outstanding speed and accuracy when employed as a backfiller.

Cleveland's perfect operator visibility and well placed foot and hand controls, clearly shown in these photos, keep operators at top efficiency for top production all day long.

Your local distributor will show you how Clevelands do more—for less

THE CLEVELAND TRENCHER COMPANY • 20100 St. Clair Ave., Cleveland 17, Ohio

CLEVELAND

- Comfortably heats workers and machines within radiation area.
- Heat not wasted on air which would normally rise to ceiling.
- No fan, motor or electrical connection needed.
- Never shut down due to power failure.
- Heat delivery cannot be diverted by drafts from open doors.
- No moving parts . . . less maintenance.
- May be used with any commercial type gas fuel.

Remember how comfortable it feels to stand in the warm sun on a cold day? That's how Panelblocs work. Gentle, comfortable heat rays warm everything they touch. You have all the advantages of conventional heaters . . . none of the disadvantages.

Panelbloc uses no fan. This means no drafts (heating is accomplished by guided radiation). With no electrical connections, Panelbloc costs less to install—will continue to operate during a power failure . . . and it heats, not air, but personnel and equipment . . . anything solid.

Panelbloc may be installed in practically any type structure for general heating; for spot heating in an otherwise unheated building; for heating a single room . . . In fact, almost any heating requirement can be solved with Panelbloc. Available in two models: 62,500 btu and 125,000 btu input.

For warm air heating check the Prat-Daniel THERMOBLOC Heater . . . used the world over.

THERMOBLOC
Division of
PRAT-DANIEL CORPORATION
33-8 Meadow St. • South Norwalk, Conn.
Send Me Panelbloc Bulletin P-154
Name_____Title_____
Company_____
Address_____

associations • *Continued*

The operating section will hold two afternoon meetings at the Biltmore hotel. Walter H. Davidson, Transcontinental Gas Pipeline Corp., chairman of the operating section, will preside.

Eight papers have been chosen tentatively for the two sessions of the operating section to be held at the Biltmore hotel. Guy Corfield, Southern California Gas Co., will discuss what the corrosion engineer can do for management. An outside speaker will talk on the economic aspect of gas distribution. C. J. Sandusky, Southern California Gas Co., will speak on quality control. Remote-control equipment will be described.

Safety programs and why they sometimes fail will be a topic at the meeting Tuesday afternoon. Underground storage is another subject, as is the value of engineering. Hall M. Henry, NEGEA Service Corp., will speak on peak shaving measures.

William B. Tippy, president, Commonwealth Services Inc., is head of a committee arranging the program for the General Management Section. A luncheon meeting will be held at the Statler hotel on Monday with Larry Shomaker, Northern Natural Gas Co., presiding as Section chairman. Speakers will be listed to talk on subjects pertaining to general management. The AGA and the PCGA insurance committees will hold a joint meeting. The Accident prevention committee will sponsor presentation of Safety Achievement Awards at a general sessions meeting. The corporate secretaries group will hear Emmet J. Leahy, of New York talk on paperwork management. George Harding, secretary, Pacific Telephone and Telegraph Co., and president, American Society of Corporate Secretaries, will be a guest at the meeting.

Community relations mat service launched by AGA

"Gas Serves You—and the Community, Too!" is the theme of a new community relations advertising mat service produced for member companies of AGA. A major activity of the 1955 AGA public information program, the ad series is designed to dramatize the local gas company as an important community citizen under the free enterprise economy.

Six introductory ads, for release on a monthly basis from July 15 through Dec. 15, are contained in a brochure mailed to nearly 400 gas companies at the end of June. These ads seek to interpret the local gas company's triple role: (1) as a growth-producing, tax-paying citizen of the community; (2) as the community's supplier of a low-cost but premium domestic, commercial and industrial fuel; and (3) as a dynamic part of the American free enterprise system.

Each ad is built around the job of a specific member of the gas company employee team. Copy stresses the interdependence of company and community and underlines the heavy stake that each has in the prosperity of the other. Strong emphasis is also placed on the contributions the privately owned and locally managed gas company makes to community stability and growth through taxes, payrolls and by supplying a premium multi-purpose fuel.

Each ad features jobs and functions common to all gas companies and copy treatment designed for easy adaptation to local situations and individual company policies. Two sizes of mats, four column by 12 in. and three column by 10 in., will be available to member companies at mat and reprint costs

K. R. Knapp (right) is presented a copy of a resolution honoring him for his significant contributions to the work of the American Society for Testing Materials Committee D-3 on Gaseous Fuels. Making presentation is L. T. Bissey, committee chairman. Mr. Knapp, recently retired as assistant director, AGA Laboratories, has served with Committee D-3 since 1935, and acted as secretary from 1947 until his retirement.

only. Suggested uses include daily and weekly newspapers and gas company publications.

Later ads in the series will dramatize the role of the gas industry's appliance testing and approval program and other phases of gas company activity under the free enterprise system.

International Gas Union to meet in New York

The sixth conference of the International Gas Union will be held at the Hotel New Yorker, New York, Sept. 25-30, it has been announced by Robert W. Hendee, president of the Union.

The International Gas Union is comprised of representatives of national gas associations of seventeen countries.

The conference will open informally on Sunday, Sept. 25, with a reception for the delegates.

Separate meetings will be devoted to transmission and distribution and to gas production, with a reception in the evening.

Utilization and gas production will be topics for sessions on Wednesday, with a luncheon sponsored by Consolidated Edison Co. A visit to the Brooklyn Union Gas Co., and a formal banquet and entertainment also are included in Wednesday's program. Thursday's session will be devoted to educational subjects and reports on requirements for international standards for gas appliances and on gas conditioning. Colonel Rockwell will deliver a formal address to close the business meeting. Thursday afternoon will be given over to a visit to United Nations. On Friday a field trip to the Harrison (New Jersey) plant of the Public Service Electric and Gas Company is scheduled.

Michigan gasmen elect R. R. Paulin president

Roland R. Paulin, vice president and manager of operations of Michigan Consolidated Gas Co., was elected president of the Michigan Gas Association at the group's annual convention at Mackinac Island. William R. Carlyon, division manager for Consumers Power Co. in Lansing, was named vice president of the association.

Three new directors also were elected. They are William H. Huffmaster, general manager of Southeastern Michigan Gas Co., Port Huron; David Eckman, vice president in charge of operations of Battle Creek Gas Co. and John B. Simpson, general supervisor of gas operations of Consumers Power Co., Jackson.

Re-elected secretary and treasurer was Milton G. Kendrick, sales manager for Michigan Consolidated in Ann Arbor.

Next job is only *minutes* away with rubber-tired Trenchmobile®

Mobility on rubber is the answer to widely-scattered trenching jobs around town, and in outlying suburban areas. A job 6 miles away can be started in less than 30 minutes from "now", with a Parsons Trenchmobile. This mobile, rubber-tired trencher runs anywhere at a moment's notice. It drives cross-town, through traffic at 12.6 m.p.h. — digs the trench at speeds up to 14½ feet per minute — drives on to next job. No waiting for trailer — no loading or unloading delays.

Digs 8 to 16 inches wide

Trenchmobile maintains fast "work-and-run" schedules on residential service connections, does pipe reclamation, trouble-shooting — is big enough, too, for main line extensions. You get trench widths from 8 to 16 inches — depths to 5 feet.

Positive down-crowd boom starts cut fast, maintains accurate grade. Self-sharpening "Tap-In" teeth assure top digging efficiency at every depth, width, and in all soil conditions. Hinged crumber sweeps trench bottom clean, ready for pipe. Sloping ladder boom also undercuts walks, curbs, gutters, cross-pipes — makes vertical set-ins. Shiftable, reversible conveyor places spoil bank on either side of trench — lets you work close to buildings, poles, without swerving from grade line.

Backfills its own trench

With 6-foot backfill blade (optional) Trenchmobile does many jobs with one-man, one-machine economy. Better see your Parsons distributor about it, or write us today. Also check Parsons 5 big, crawler-mounted Trenchliners®.

P553 GAS

Want more facts? mail to: PARSONS Company, NEWTON, IOWA (Koehring Subsidiary)

Send us latest bulletin on rubber-tired 88 Trenchmobile.

NAME _____ TITLE _____

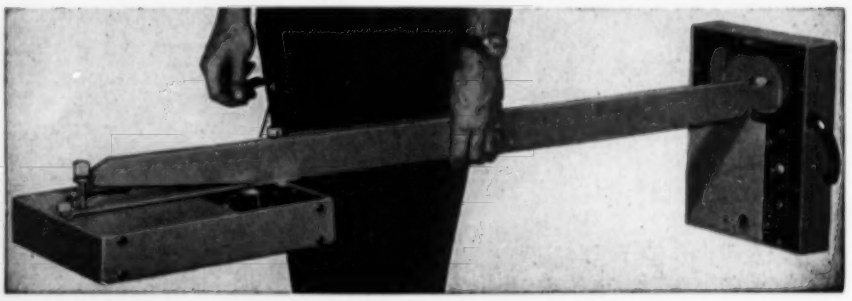
COMPANY _____ DIV. _____

STREET _____

CITY _____ STATE _____

THE WILKINSON LINE LOCATOR

A precision instrument for detecting the position and depth of any sub-surface pipe, cable, stub, valve, coupling, etc.

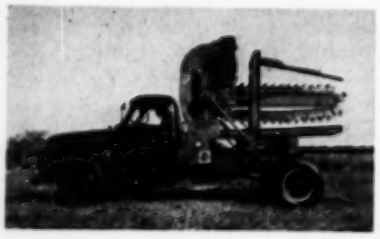


The dependability of the Wilkinson Line Locator is amply attested by its wide use. Leading gas, oil and pipe line companies generally KNOW its value.

WILKINSON PRODUCTS COMPANY

3987 Chevy Chase Drive • Pasadena 3, California • SYlvan 0-4314

EARTHRIPPER*®



• Unique, Mobile Ditching Machine

The pioneer rubber-tired trencher, the Earthripper, will make money for you because — one man transports and operates; is self-levelling; no hand digging because it digs at any angle leaving a clean ditch; it is as easy to move as driving a truck; and it ditches to 8' deep, 10" to 30" wide.

• Write for folder giving complete details

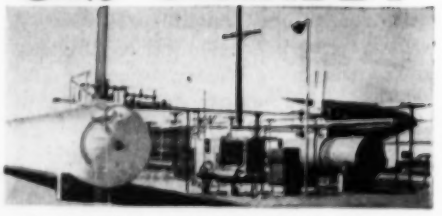
*PAT PENDING

OWEN-PEWTHERS

Manufacturing Company

P. O. Box 540 • College Station, Texas

GAS STANDBY



Packaged 12 mcfh plant designed and built by Draketown for . . .

- ★ **Utility or Industrial standby**
- ★ **Peak shaving and augmentation**
- ★ **100% Town or plant supply**

A Packaged Draketown Propane Plant will help you reduce demand charges; provide a supply of gas during curtailment periods . . at the turn of a valve . . . or supply that outlying section or plant 100% if desired.

DRAKETOWN® PROPANE PLANTS

" Good Gas Insurance "

If you have a gas problem, we can help you. We operate from coast to coast and overseas.

Phone or write today — no obligation.

DRAKE & TOWNSEND

Consulting • Design • Engineering • Construction

11 WEST 42ND STREET • NEW YORK 36, N. Y.

GAS calendar

August

15..Southeastern Gas Association Short Course in Gas Technology (ending Sept. 10)—Raleigh, N. C.

29-31..15th Annual Appalachian Gas Measurement Short Course—West Virginia University, Morgantown, W. Va.

September

7-9..Mid-West Gas Association Gas School & Conference—Iowa State College, Ames.

9..New Jersey Gas Association—Hotel Monmouth, Spring Lake, N. J.

11-13..INGAA Annual Meeting—Jasper Lodge, Alberta.

14-15..AGA Accident Prevention Conference—Marion Hotel, Little Rock.

23..Oklahoma Utilities Association Gas Division—Oklahoma City.

16-17..Maryland Utilities Association Fall Conference—Virginia Beach, Va.

25-30..International Gas Union 6th Conference—Hotel New Yorker, New York.

October

12-14..Wisconsin Utilities Association Electric & Gas Section—Schroeder Hotel, Milwaukee.

12-14..GAMA Annual Meeting—El Mirador Hotel, Palm Springs, Calif.

17-19..1955 AGA and PCGA Convention—Los Angeles.

24-27..National Association of Railroad & Utilities Commissioners—Asheville, N. C.

25..NEGA Operating Division—Hotel Statler, Boston.

November

13-18..American Society of Mechanical Engineers—Congress & Hilton Hotels, Chicago.

14-17..American Petroleum Institute—San Francisco.

16-18..Southeastern Gas Association—Roanoke Hotel, Roanoke, Va.

28-30..SGA Advisory Council & Management Conference—

Grand Hotel, Point Clear, Ala.

1956

February

15-17..Tulsa Corrosion Short Course for Pipeliners (NACE) — Mayo Hotel, Tulsa.

March

12-16..National Association of Corrosion Engineers Annual Meeting — Hotel Statler, New York.

19-20..Indiana Gas Association — French Lick Springs Hotel, French Lick, Ind.

19-21..MidWest Gas Association — Hotel Fontenelle, Omaha.

22-23..New England Gas Association Annual Meeting — Hotel Statler, Boston.

22-23..Oklahoma Utilities Association Annual Convention — Oklahoma City.

April

4-6..AGA General Management Section Spring Conference — Conrad Hilton Hotel, Chicago.

16-19..AGA Sales Conference on Industrial & Commercial Gas —Hotel Roanoke, Roanoke, Va.

17-19..Southwestern Gas Measurement Short Course — University of Oklahoma, Norman.

16-18..National Conference of Electric & Gas Utility Accountants — Hotels Biltmore and Commodore, New York City.

19-21..GAMA Annual Meeting — The Greenbrier, White Sulphur Springs, W. Va.

23-25..Southern Gas Association Annual Convention—Dallas.

May

7-10..AGA Distribution, Motor Vehicles, and Corrosion Conference—Congress Hotel, Chicago.

10-11..AGA Gas Supply, Transmission & Storage Conference—Conrad Hilton Hotel, Chicago.

16-18..AGA Chemical Engineering & Manufactured Gas Production Conference — Philadelphia.

THE NORMAC BELL JOINT CLAMP

A SIMPLE SOLUTION for one of the GAS INDUSTRY'S *most trying problems*

Solves Your Joint Repair Problems • Quick • Easy • Permanent

Installed in small pavement openings. Available in all standard sizes from 3" to 12". A simple set of tools cleans the joint, installs the clamp . . . often in only a quarter of an hour. SAVES TIME, SAVES MONEY and the repair is permanent. Designed for all conditions particularly where pavement repair costs are prohibitive. Such small opening repairs are scarcely noticeable when pavement is replaced.

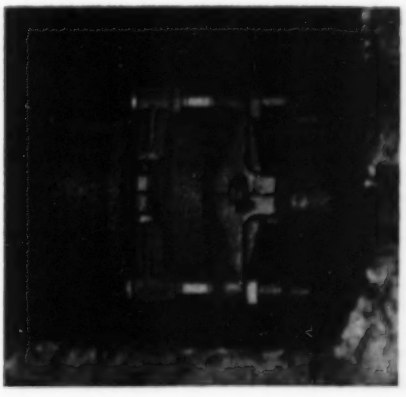
Normac Clamps can be installed in large as well as small openings.

Norton-McMurray hold definite leadership in the development of methods for installation and rehabilitation work through small openings. We welcome the opportunity to help solve a problem you may have—tell us about it.

Write for our catalog describing our complete line of

COUPLINGS . . . FITTINGS . . . SERVICE TEES and ELLS . . . SLEEVES . . . COMPRESSION-END COCKS . . . METER BARS and BRASS FITTINGS for copper pipe.

6 inch Normac Clamp being lowered into hole for installation



6 inch Normac Clamp in service after installation

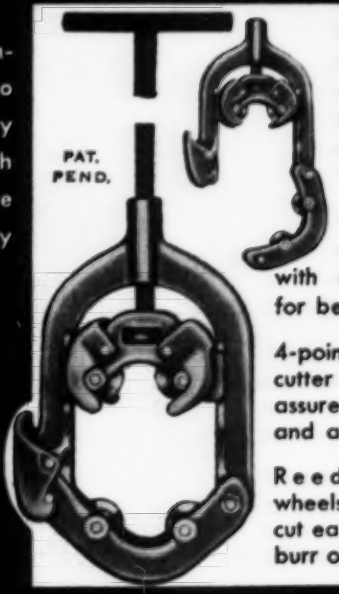
NORTON-McMURRAY MFG. CO.

122 SOUTH MICHIGAN AVENUE • CHICAGO 3, ILLINOIS

Method and product covered by U. S. Patents, Nos. 2,163,261 and 2,178,286.

IF YOU CUT LARGE DIAMETER PIPE...
YOU NEED THESE
New REED HINGED 4-WHEEL PIPE CUTTERS
Four sizes cover the range from 2½" to 12"

Users tell us these completely new cutters are so efficient they often "pay for themselves" through the savings in crew time on a half-dozen cuts. They are the first really practical tools for cutting off steel or cast iron pipe in sizes from 2½" to 12". You can, for example, cut 8" steel pipe completely off in less than five minutes.



Four wheel design requires minimum swing of handle—less digging in ditch work, easier "tight-corner" cuts.

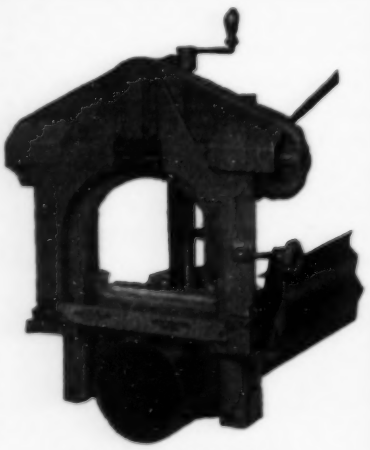
Closed frame permits light weight with complete rigidity for better cutting.

4-point guide aligns the cutter on the pipe . . . assures perfect tracking and a right angle cut.

Reed Razor Blade wheels track perfectly, cut easily and roll down burr on steel pipe.

Unconditionally guaranteed to be the most efficient cutter you have ever used. Ask your jobber or write for literature.

REED MANUFACTURING COMPANY
ERIE, PENNSYLVANIA • U. S. A.



NEW WACHS PORTABLE POWER SAW

No Flame—Safe Cuts Under Hazardous Conditions!

FASTER—SAFER—ACCURATE!
Cuts 2", 4", 6" & 8"
Cast Iron and Steel Pipe

WACHS GUILLOTINE SAW FACTS—
- Cuts Fast
- Cuts Clean
- Cuts Square
- Height 28"
- Width 22¼"
- Depth 12"
- Set up time, less than one minute
- Power—electric or air motor
- Weight 105 pounds

For further information write to:
THE E. H. WACHS COMPANY
1525 N. Dayton Street • Chicago 22, Illinois

Positive Protection!
from Runaway Pressures! Fires!
NORWALK POSITIVE PRESSURE CUT OFF VALVES

- Gives automatic shut off when excessive pressure arises or fire occurs!
- Easily reset to desired cut off pressure!
- No pressure loss!
- All parts external to gas flow!
- Quickly reset after operation!
- Sizes from 2" to 36".

SEND FOR FULL PARTICULARS

NORWALK VALVE CO.
South Norwalk, Conn.

GAS association notes

Safety awards, films, and panel discussions will highlight the 7th annual accident prevention conference co-sponsored by the AGA and Southern Gas Association accident prevention committees, Sept. 14-15 at the Marion hotel in Little Rock. More than 100 delegates are expected to attend. Conference sessions include an appraisal of gas industry safety, fleet safety, barricading practices, leak detection techniques, and two field trips to compressor stations.

L. O. Koven & Brother Inc., Jersey City, N. J., has been elected a member of the gas water heater division of GAMA, bringing to 49 the number of members in the division.

Mrs. Phyllis D. Kilkenny has joined the public information bureau of AGA as domestic gas publicity writer. She will produce and distribute stories on domestic gas utilization for local company use, contact and service national magazines, and prepare press kits and publicity support for national promotional campaigns.

C. P. Larrabee, applied research laboratory, United States Steel Corp., Monroeville, Pa., has been named chairman of the technical practices committee of NACE. E. P. Greco, senior research chemist, United Gas Corp., Shreveport, is vice chairman.

W. Frank Fisher, vice president and general manager of the Floyd-Wells Co., division of the John Wood Co., was elected president of the Institute of Appliance Manufacturers at its 23rd annual convention-exhibit in Cincinnati. Other officers include F. H. Guthrie, Newark Stove Co., executive vice president; S. B. Rymer Jr., Dixie Products Inc., secretary-treasurer; and Robert H. Taylor of Florence Stove Co., Walter F. Rogers of Crown Stove Works, and Wendell C. Davis of Cribben & Sexton Co., vice presidents.

New officers of the California Natural Gasoline Association for the fiscal year 1955-1956 took over at the association's annual board of directors meeting held in Los Angeles last month. C. L. Case, Continental Oil Co., Ventura, received the gavel from outgoing President A. C. Lyles, General Petroleum Corp. Serving with Mr. Case as vice president is Raymond W. Todd, Pacific Lighting Gas Supply Co. Among new members of the board are M. L. Fort, Pacific Lighting; Grove Lawrence, Southern California Gas Co.; and A. H. Weil, United Gas Pipeline Co.

GAS people

Promotions

Crane Co., Chicago, has elected FRANK F. ELLIOTT to the office of president and chief executive officer.

EMIL P. NENSEL, formerly product manager for Servel's Wonderbar refrigerette and water heater lines, has been named manager of the company's new sales service department.

WILLIAM G. LAUFFER has become head of the mechanical plant betterment group of the consulting engineering department of Ebasco Services Inc., New York, succeeding the late ARTHUR H. KRAUSS.

WILLIAM J. CURNOW, affiliated with the methods department of the Columbia Gas System Service Corp., has been appointed special assistant to the treasurer of the Pittsburgh group.

LOYD E. HAMPTON has been named to succeed W. B. CURREY as manager of United Gas Corp.'s Nacogdoches, Texas, district. Retiring after 44 years of service in the Texas natural gas industry, Mr. Currey's service with United Gas has been continuous since 1911 with the exception of a one-year leave of absence during World War I.

DR. RALPH P. HUDSON has been appointed chief of the cryogenic physics section of the heat and power division of the National Bureau of Standards, Washington, D. C.

JACK E. BATEMAN, senior market analyst, has been named manager of market research at Rockwell Manufacturing Co., Pittsburgh, succeeding A. CLARK DAUGHERTY, who has been assigned other corporate duties in addition to maintaining overall supervision of market research and public relations.

DUDLEY B. W. BROWN has been elected vice president and secretary of American Natural Gas Co., New York.

JAMES H. MARKS, operating manager of Equitable Gas Co., Pittsburgh, has been elected vice president in charge of operations.

HAROLD H. HIPPLER has been promoted to the post of general sales manager of Gar Wood Industries Inc., Wayne, Mich.

ACF Industries Inc. has promoted JOHN E. ANGST to vice president, sales,

ARCCO
ARCCO... NOW OFFERS 8 DAY CHARTS and ROCKWELL CHART DRIVES
EIGHT-DAY ARCCO CHARTS are now available for use on practically all Rockwell-Emco, Foxboro and Westcott orifice meters. Eight day charts for other instruments soon available.
With this NEW Chart Drive 11 rotation speeds are possible. Turrets are available for 2, 3, 4, 6, 8 and 12 hours, also for 2, 3, 7, and 8 day rotation. Standard hub gives 24 hour rotation.
ROCKWELL CHART DRIVES are ruggedly built and are sealed for years of trouble-free service. The drives are adaptable to practically every type of instrument using circular charts. The price is $13.75 each. Turrets are $4.25 each F.O.B. Los Angeles, Calif., or Tulsa, Oklahoma.
AMERICAN RECORDING CHART CO.
3113 E. 11th St. • Los Angeles 23, Calif.
SEND FOR DRIVE AND CHART BULLETIN
SEND FOR BULLETIN NO. 104-R

1897 1955

PIPE STOPPERS OF ALL KINDS

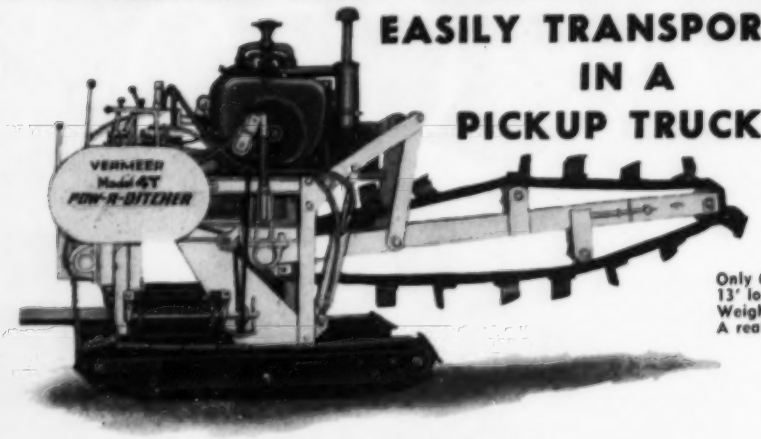
SAFETY GAS MAIN STOPPER COMPANY

GOODMAN USED SINCE 1897 2" HANDLE & LOCKING SLEEVE GAS MAIN STOPPER

523 Atlantic Avenue
Brooklyn 17, N. Y.
Cable Address GASTOPPER, N. Y.

POWERFUL NEW "MIDGET DITCHER"

EASILY TRANSPORTED IN A PICKUP TRUCK



Only 6' high, 13' long. Weighs 2500 lbs. A real workhorse.

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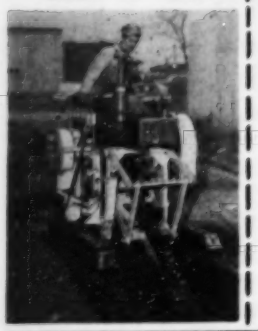

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people • *Continued*

with headquarters in Chicago, and ELLSWORTH B. CARPENTER to vice president, sales, with headquarters in St. Louis.

Cleveland Trencher Co., Cleveland, Ohio, has promoted E. B. VOLMAR to vice president in charge of manufacturing, CLIFFORD P. MORGAN to sales manager, and DAVID L. RAYMOND to chief engineer.

Three members of the general operating department of the Oklahoma Natural Gas Co. have been promoted. J. E. JOHNSON, assistant to the general superintendent, is now superintendent of transmission, production, and engineering; M. J. PETERSON has been promoted from assistant to chief engineer; and J. H. GLAMSER, assistant to the general superintendent, is now superintendent of distribution, utilization, and cathodic protection.

WALTER T. LUCKING, vice president in charge of operations, has been elected president and director of Arizona Public Service Co., Phoenix, succeeding HENRY B. SARGENT, who resigned to become president of American & Foreign Power Co. JOHN L. LIECTY, treasurer, and A. H. FORMAN JR., executive vice president, have been elected directors; CLAIRE TITUS, assistant to the president, has been elected a vice president; and FRANK L. SNELL was elected chairman of the executive committee of the board.

W. F. McNaughton
Plicoflex

W. B. Tippy
Commonwealth

WILLIAM B. TIPPY has been elected president of Commonwealth Services Inc., New York. He succeeds GRANVILLE H. BOURNE, who was elected to the newly created office of chairman of the board.

New faces

WALTER F. MCNAUGHTON has joined Plicoflex Inc., Los Angeles, as national sales manager, where he will engage in establishing a sales distribution system for Plicoflex tapes. For the

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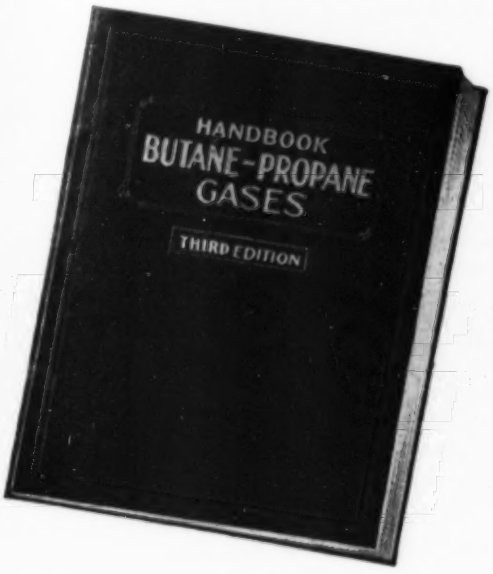

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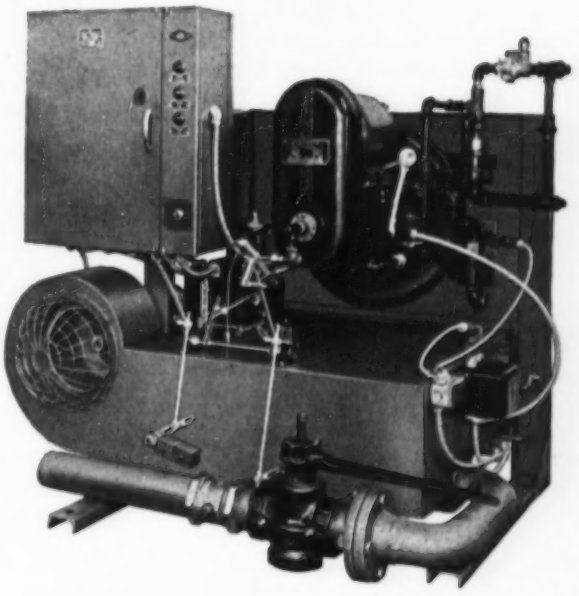

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past eight years, Mr. McNaughton has been identified with the manufacture and sale of corrosion resistant plastic tapes.

Consolidated Natural Gas system, Pittsburgh, has appointed KENNETH E. HAASE purchasing agent for four of its subsidiaries. HERBERT F. YOUNG is the newly named assistant purchasing agent.

BERT SCHAEFER has joined Florence Stove Co., Chicago, as Midwest division manager replacing F. O. BLAKE. Mr. Schaefer was formerly appliance sales manager of the Admiral Corp. Florence Stove has also named J. ROSS SIMMS as southwestern division manager, replacing T. E. COOK, who is retiring. SEYMOUR COOPER has joined the company as district manager for the greater New York area.

RAY S. TURNBULL has joined Ward Heater Co., division of Kresky Manufacturing Co., Petaluma, Calif., as a member of the Los Angeles office sales engineering staff.

D. H. ROWE has joined Ridge Tool Co., Elyria, Ohio, as assistant sales manager.

WARREN A. LOGELIN has joined Crane Co., Chicago, as assistant director of public relations. The company also announces that LEO L. DAUGHERTY, a 32-year Crane veteran, has been appointed an assistant treasurer of the company.

EARL TRAGER, former senior geologist with the FPC, has joined H. Zinder & Associates Inc. as chief geologist.

FRANK HAMILTON, vice president of Bankers Trust Co., New York, is a new director of Consumers Power Co., Jackson, Mich.

ALBERT E. MANOFSKY has joined Sherman Products Inc., Royal Oak, Mich., as chief engineer.

Servel Lnc., Evansville, Ind., has added six new field representatives: RICHARD J. ROZA and JAMES G. HAYDEN, midwestern region; DARRELL R. DAVIDSON and GEORGE S. ANDREWS, southwestern region; RICHARD KLEINMAN, eastern region; and PAUL WESTHEIDERMAN, southern region.

Transfers

PAUL LADY, who has been associated with Jenkins Publications for 15 years, has left that organization to establish an industrial advertising agency in Los Angeles. He plans to provide a specialized advertising and merchandising service for companies manufacturing products used in the L.P. gas industry.

Fred Kaiser
Mich. Consolidated

Paul Lady
Advertising

Mr. Lady served as advertising salesman and advertising manager on both *GAS* and *BUTANE-PROPANE News*. He held the position of general manager since 1951.

FRED A. KAISER has been elected vice president and sales manager of Michigan Consolidated Gas Co., Detroit. Mr. Kaiser was formerly president of the Detroit-Michigan Stove Co.

Deaths

H. Carl Wolf

H. CARL WOLF, who earlier this year resigned as managing director of the AGA because of ill health, died on June 26 in White Plains, N.Y. He was 63. Mr. Wolf's long career in the utility industry began when he became manager of the Edwardsville (Ill.) Water Co. After World War I service, he served as chief engineer of the PSC of Maryland, later joining Central Public Service Corp. in Indiana. Later he became vice president of Consolidated Electric & Gas Co. and then president of Central Indiana Gas Co. and all of its associated companies. In 1938, he became president of the Atlanta (Ga.) Gas Light Co. and its affiliates.

In 1945 he was elected managing director of the AGA, where he played a very prominent part in the development of the PAR program.

PAUL R. SMITH, 51, vice president and a director of the Anchor Gasoline Corp., Tulsa, died in June while on a fishing trip in Minnesota. Mr. Smith was associated with Warren Petroleum Corp. and was active in that firm's marketing division until 1940, when he became one of the organizers of the Anchor Petroleum Co.

EDWARD JOHN TUCKER, 65, for nine years vice president and general manager of Consumers Gas Co. of Toronto, died recently. One of the prime organizers in the development of the Canadian gas industry, Mr. Tucker initiated negotiations in the U. S. which resulted in Toronto being served with natural gas. Mr. Tucker joined Consumers in 1910.

JAMES E. PEW, a member of the board of directors and manager of the natural gas and natural gasoline division of the Sun Oil Co. died suddenly in June. He was 54 years old. Mr. Pew was also president of the National Council for L.P. Gas Promotion.

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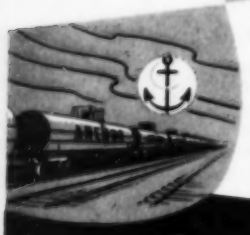

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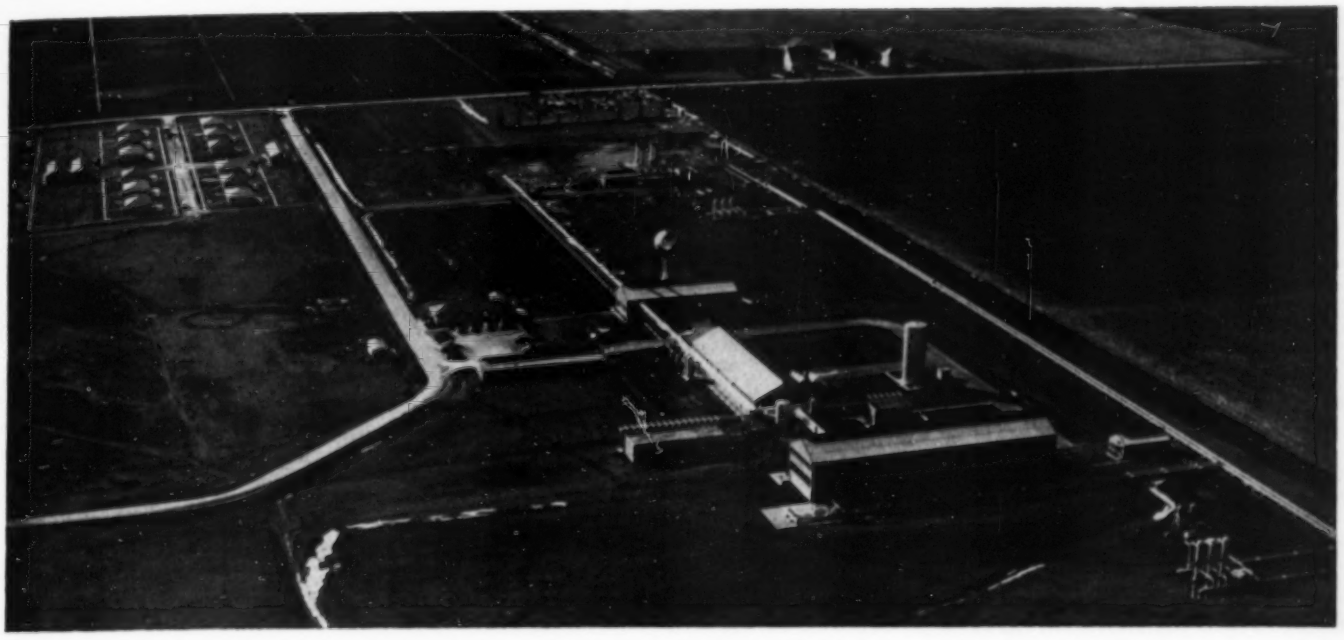
Overall view of aboveground facilities at Herscher storage field. Compressor station in lower right foreground compresses gas entering the field for storage and can also be used to recompress the gas on the delivery cycle, if necessary. Dehydration equipment is in center background.



HERSCHER: First use of water sand for natural gas storage

By J. FRED EBDON • Managing Editor

BUILD more new pipelines or develop some type of large-volume gas storage facility?

That was the question faced by the management of Natural Gas Pipeline Co. of America and Texas Illinois Natural Gas Pipeline Co., subsidiaries of Peoples Gas Light & Coke Co., Chicago, in the early 1950s.

The solution to that problem lay in the development of Herscher dome storage field, which today is a "going concern"; but the trail to this result has not been a smooth one for shortly after full-scale injection was begun in August 1953 leaks developed, the search for which has been a challenge to the staff's ingenuity.

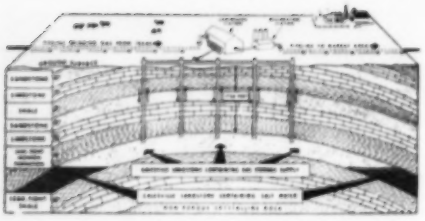
The regulatory and public relations aspects of the story have been chronicled* during the development period; now, for the first time, the engineering and design story may be told. Conservative management, reluctant to speculate on the ultimate success of the engineering methods used to overcome some of the troubles, is now convinced that Herscher dome will be permanently successful.

The story began back in the postwar period when increasing supplies of natural gas for househeating began intensifying the historic peak-load problem of the Chicago and northern Illinois area utilities. At one time, waiting lists for househeating among one-family dwellings alone in Chicago and surrounding territories reached 200,000; and each month, these lists were being swelled by 10,000 new applications.

Lack of natural storage facilities such as depleted gas or oil fields was a major roadblock, and means to circumvent it were under study at that time; new liquefaction methods were explored, as was the possibility of hollowing out deep caverns in limestone formations, but both ideas were abandoned in favor of Herscher, an aquifer formation that appeared to have good storage characteristics, but which had never held any measurable quantities of native gas.

The greater Chicago area was, and is, supplied natural gas from three major transmission lines. Natural Gas Pipeline Co. of America operates two essentially parallel transmission lines originating in the Panhandle field in

*GAS bibliography.



Texas. Texas Illinois Natural Gas Pipeline Co. operates a 1400-mile pipeline from the productive Texas Gulf Coast fields. As a means of supplementing this capacity, underground storage was favored on the basis of these considerations:

(1) At the time the project was being considered, it was estimated that an underground storage facility could deliver a peak-day maximum, combined with the deliveries from the three pipelines, that would be 2½-times greater than the capacities of the pipelines alone.

(2) A storage field could do as much, in meeting the prodigious househeating demand, as three additional major long-distance transmission lines, each costing in the neighborhood of $185 million to construct.

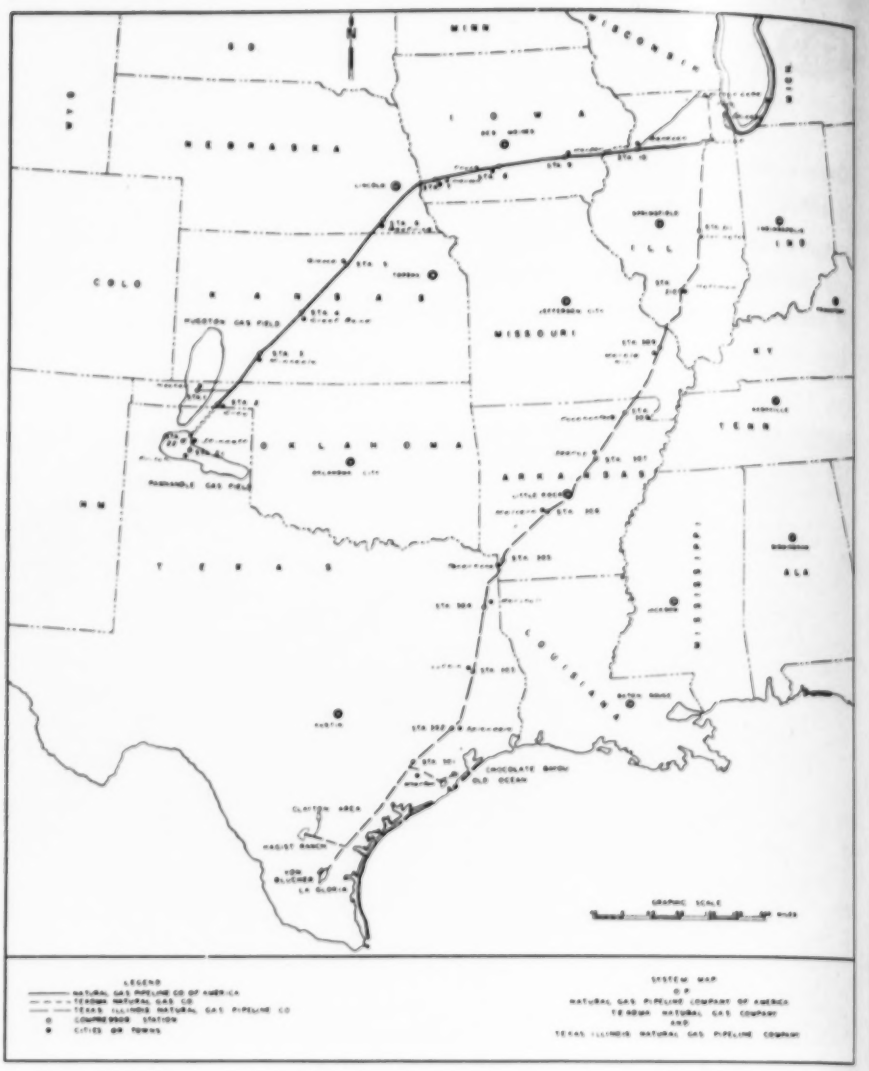
(3) It was estimated that the storage facility could be built for an initial cost of $15 million to $20 million, and that the final cost after maximum development would approximate $45 million.

Geographically, the Herscher dome field appeared to be in an ideal location. Situated near the village of Herscher, Ill., the field lies about 55 miles south and west of Chicago's city limits, and is just 44 miles from the terminals of the three long-distance pipelines near Joliet. Actually, the apex of the storage structure lies about one-half mile south of the village of Herscher, in western Kankakee county. The Herscher anticline underlies approximately 15,000 acres, or nearly 24 square miles. It is 8½ miles long and 4 miles across at the point of maximum width.

Geologists estimated in 1952 that about 90 billion cu ft of natural gas could be stored at Herscher. This supply was further estimated to be adequate to make available sufficient utilization gas to supply the backlog of waiting space-heating customers and to meet foreseeable demands for all space heating in the Chicago region.

GEOLOGY OF THE FIELD

Four principal geological characteristics are required for a successful storage region. These are:



Map showing gas transmission lines from the Southwest serving the Chicago area.

(1) That there be a geological structure large enough, and with enough closure, to hold a gas "bubble" of sufficient volume. The structure must prohibit lateral migration of stored gas.

(2) The reservoir stratum must be thick enough to hold this volume. In addition, porosity and permeability must be ample to supply adequate void space for storage and to allow efficient passage of the gas through the sand to and from input-withdrawal wells.

(3) The stratum must be far enough below the earth's surface to assure safety for surface improvements and habitations.

(4) The storage stratum must be capped with an impervious stratum.

All of these conditions were judged to be met by the structure at Herscher dome.

The storage bed at Herscher dome is the Galesville sand, a Cambrian-period, water-bearing sandstone about 100 ft thick that reaches to within 1750 ft of the surface at the zenith of the anticline structure. It is unlike practically all other storage structures, which utilized depleted oil or gas sands. An aquifer must also have the ability to displace the water without excessive gas injection pressure.

Tests have revealed that the Galesville sand is admirably suited for this requirement, which is dependent on characteristics of porosity, permeability, thickness, and the areal extent of the water sand. The porosity of the Galesville, a coarse sandstone, tests relatively high, being about 18.5% net. Its thickness is 100 ft and on an average, one-half of this would contain natural gas if the water was excluded to the 1170-ft contour. There are about 6000 acres within the 1170-ft contour, and it is a considerable distance to any spill-point indicated by structural mapping. It has been concluded, then, that in view of the fact that permeability is good and the other characteristics are equally promising, gas can displace the water

in the formation very satisfactorily.

The ability of the cap rock to retain the injected natural gas cannot be so readily assumed. For one thing, most of the permeability measurements available to oil and gas industry geologists are data obtained from the study of cores taken from producing formations; therefore, no definite permeability (ability of a reservoir to allow passage of fluids under a pressure gradient) has been established for the Ironton formation, which is a bedded, dolomitic sandstone. All tests to date indicate that this formation has low permeabilities on the order of 0.0005 millidarcy in both the vertical and horizontal directions. From all existing data, it would appear that the Ironton has the characteristics of a good cap rock; although some leakage has been experienced at Herscher, it is generally accepted that the capping formation is not responsible for the loss of the relatively small volumes of gas from the storage reservoir.

Consulting geologists presently estimate that approximately 150 billion cu ft of natural gas can be stored with the water displaced to the 1170-ft contour. The storage volume of 25 billion cu ft of gas contemplated for 1955-56 will fill only a fraction of the reservoir. As previously stated, the Galesville sand is extremely permeable and the wells can be produced at high volume rates of flow with a small resultant drop in well head pressure. The Federal Power Commission has been petitioned for a permit to construct facilities to increase the deliverability from 150 to 430 MMcf per day.

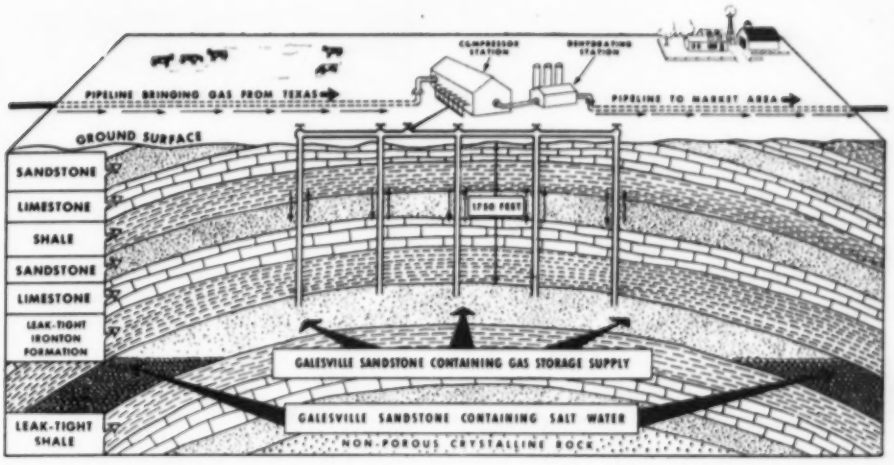
DRILLING PROGRAM

The anticline at Herscher dome was the scene of shoestring shallow oil production in days gone by. Many wells were drilled for oil production, the oil formations, such as they were, were depleted, and the wells abandoned. Most of these are bottomed in the Galena limestone formation and records detailing their locations were few. Most of the abandoned oil wells were located by company forces during the early development of Herscher.

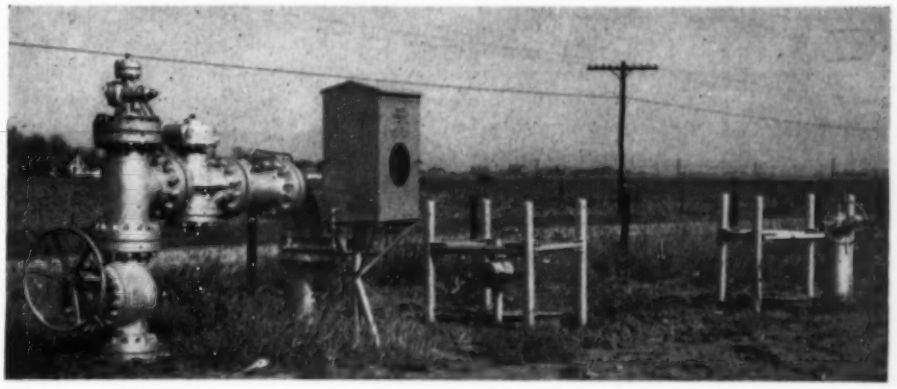
A total of 20 injection-withdrawal wells for storage gas have been drilled into the Galesville sand. In addition, one well was drilled into the top of the dome and 8 wells were drilled at strategic locations downstructure to serve as observation wells to orientate the position of the gas bubble, and five other exploratory wells have been completed in the various strata above the Galesville.

The injection wells are completed in the Galesville sand with 8⅝-in. casing. A water-string casing of larger diameter pipe has been set to exclude and protect fresh water horizons in the upper formations. All casings were set from surface to total depth by the circulating cement method utilizing all reputable techniques. This practice gives full protection from fresh water sands and other porous zones above the storage zone.

The existence, size, and shape of the Herscher dome were delineated by core-drilling more than 100 holes into a shallow marker formation that was known to roughly parallel the Galesville. Seismograph refraction data confirmed the core-drilling data. Five test wells were drilled to a total depth of slightly more than 2000 ft to give accurate data on the composition and characteristics of the reservoir stratum and the strata above and below it. These holes were used in the determination of bottom hole pressures.



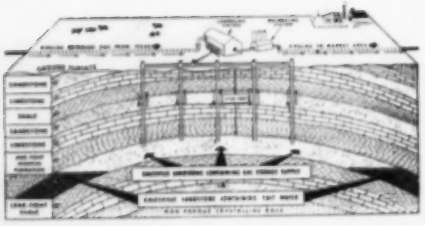
Artist's cross section diagram of anticline structure at Herscher. The 100-ft thick Galesville sandstone is being used as a reservoir for seasonal storage of natural gas.



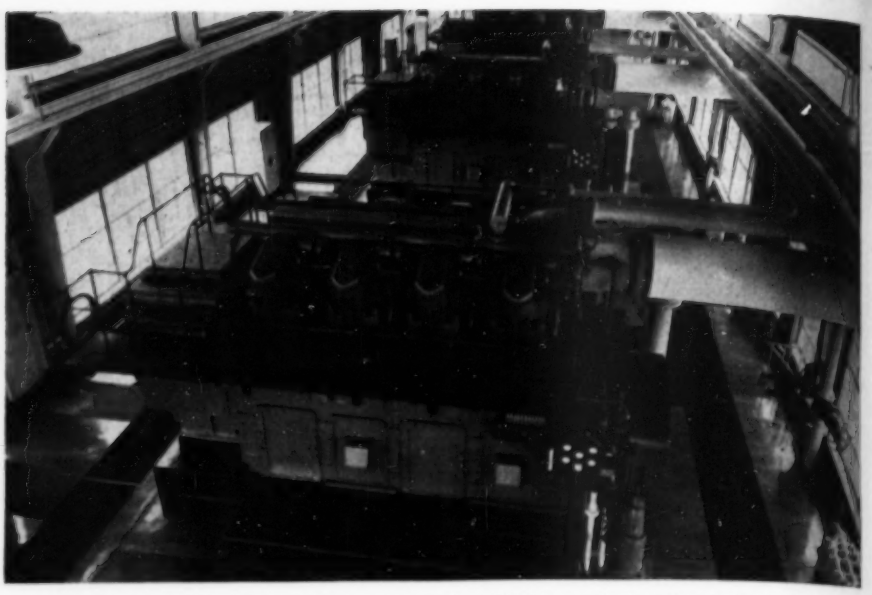
At left is the Christmas tree of an Orbit-valve equipped combination injection-withdrawal valve. A horizontal wellhead separator is flanged to the valve. A 10-in. riser goes underground to connect with the field line. Orifice-tapped welding-neck flanges are on the lower end of the elbow. A weatherproof meter box and a 10-in. blowdown stack and valve are shown to the right of the wellhead installation.

OPERATION AND FACILITIES

Natural Gas Storage Co. of Illinois, an Illinois corporation that is a subsidiary of the pipeline companies, was formed to construct, develop, and operate the Herscher underground gas storage project. The operations necessitated installation of aboveground facilities similar to those for a naturally producing gas field, but in addition some special equipment had to be installed and some unusual designs had to be incorporated in components to accommo-



date gas injection. Christmas trees, wellhead condition recorders, field lines and headers, a compressor station, and a dehydrating station were originally required. Much other control and operating equipment has been installed in addition to the basic components.



Interior view of five Cooper-Bessemers, rated at 2000 hp each, installed in Station 201.

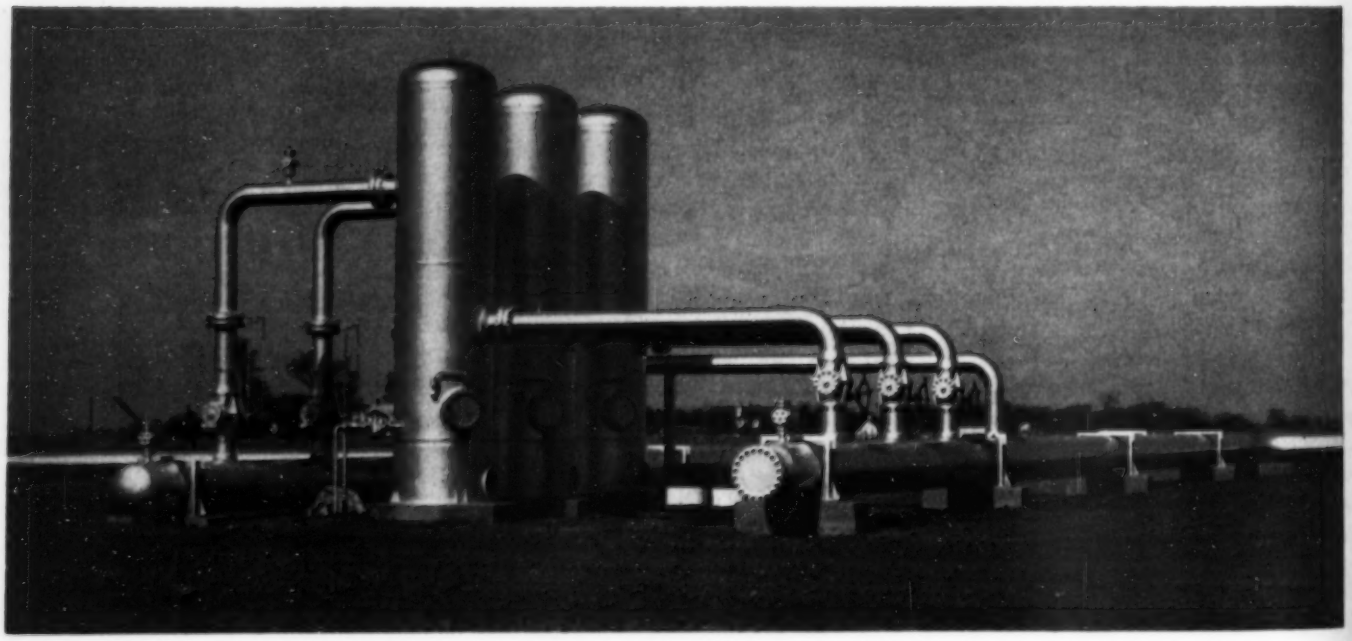
COMPRESSOR STATION

Herscher's main compressor station, Station 201, differs from conventional design in that the piping is arranged to permit reversal of the flow direction of the natural gas both into and out of storage.

On the injection cycle, gas from the Southwest is delivered from the Texas Illinois line in the usual manner through a bank of scrubbers (for dust and foreign material removal) and into the compressor station. From the compressor cylinders, it is transmitted to a second bank of scrubbers (for oil removal) and then through the field piping to wells that inject it into the Galesville storage horizon as the gas pressure drives the formation's salty water lower by displacement.

On the producing or delivery cycle, gas is withdrawn from the same wells that were used for injection and carried through the same field piping. It may or may not be subjected to recompression in the compressor station, depending on the existing wellhead pressure at the time of production. In any case, the gas produced will be saturated with water as it is withdrawn from the aquifer, so it is always necessary to extract the entrained water vapor by passing the gas through the extensive equipment in the dehydrating station. The piping design differs from the double manifolding arrangement, as usually used in previous reversible compressor facilities for storage service, in that the compressor piping (including suction and discharge lines) is used in both cycles.

The compressor building houses five 2000-hp Cooper-Bessemer GMW engines. Suction and discharge headers are designed to allow expansion to 32,000 hp if and when required. Provisions were made for enlarging the compressor building, as well as the cooling and cleaning equipment in the 76-acre compressor station area, should such expansion ever be necessary.



A bank of three Fish Engineering-designed, A. O. Smith built dust scrubbers installed in parallel on the suction line (from the mainline) to the compressor station. Connections to facilitate addition of units can be seen on the ends of the headers.

INJECTION CYCLE

Inlet pressure to the compressors generally is in the range of from 500 to 550 psig, and the discharge pressures vary between 700 and 750 psig. All station piping is designed for a maximum allowable operating pressure of 1000 psig in compliance with the ASA Code for Pressure Piping, B31.1 to assure safe operations at elevated pressures as needed.

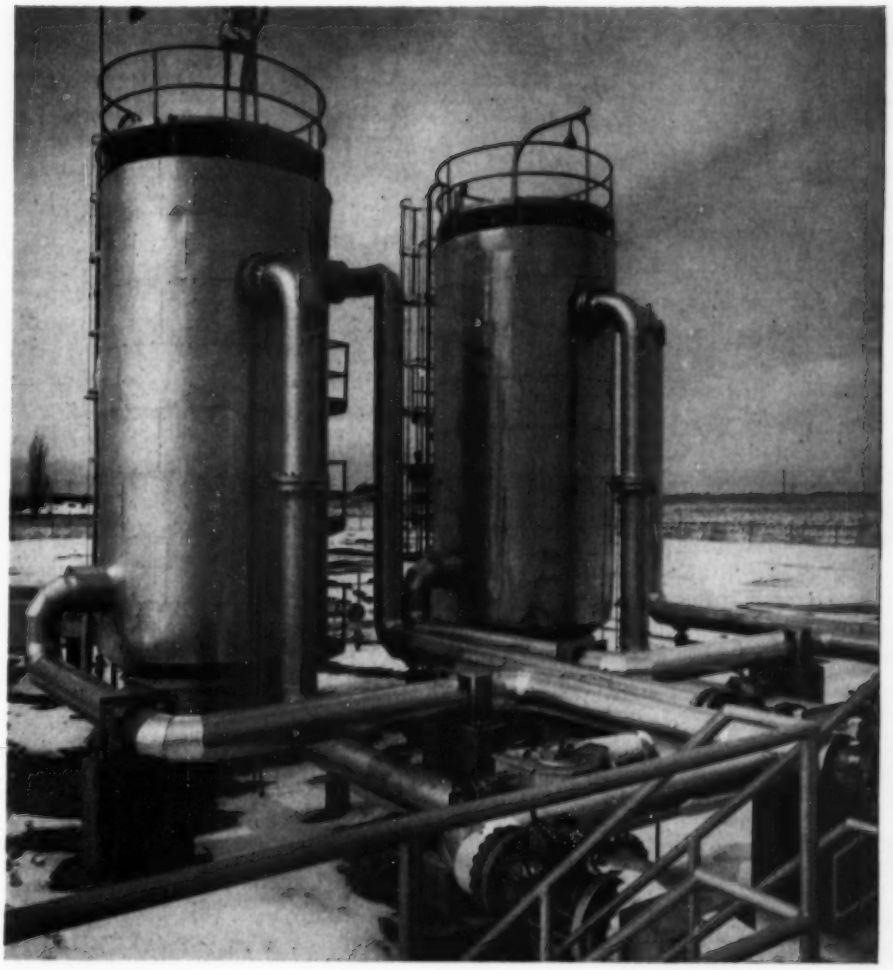
Five Fluor Fin-Fan units were installed to provide cooling for the engine jacket and other cooling water. The Fin-Fans are designed so that overhead-type rolling doors can be positioned to allow more or less air volumes to circulate through the units in indirect relation to the cooling water temperature requirements. During periods when the ambient temperature is unusually low, gas-fired steam generators supply steam to warm engine jacket water.

Sixteen-inch suction and 12-in. discharge risers extend from the respective headers to each of the compressors. A 6-in. line, with valve, is tied-in between the compressor suction and discharge lines, and serves as a compressor bypass. A 6-in. vent line is buried under the suction and discharge headers, and connected through both automatically and manually operated valves into suction and discharge risers. The vent lines are equipped with Garrett pressure-relief valves that can be set to open at any desired pressure within their range. The relief valves are usually set for operation at between 900 and 1000 psig, but they can be manually operated by depressuring through a ¼-in. control valve.

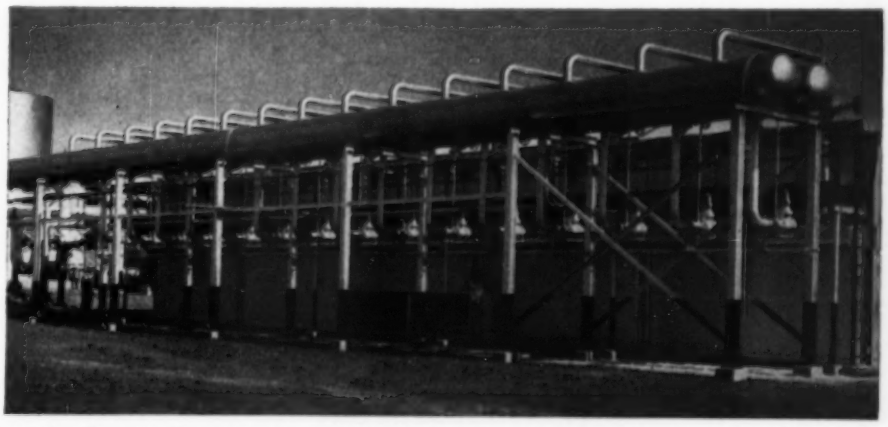
Dust scrubbers

On the injection cycle, natural gas is received from the mainline through three A. O. Smith Corp.-built dust scrubbers installed in parallel. Fish Engineering Co., Houston, designed this equipment. Headers on the scrubbers are designed to permit expansion of the bank if required. From the scrubber installation, gas flows to the compressors, through three parallel oil removal scrubbers, and into the storage sand. It is imperative that all oil and other foreign material be removed from the gas before it is delivered to the formation for storage. Foreign materials would fill the interstices of the sand if allowed to be injected. Interstitial volume is vital for the maintenance of porosity and permeability in the sand. Water soluble compressor cylinder lubricants are used to insure that the sand face of the well bore will not be contaminated.

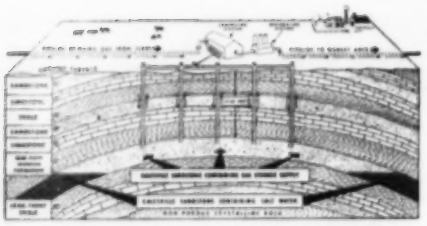
On the withdrawal cycle, sand and water production are always likely, so it is necessary to pass the produced gas through separators and dehydrators. Under some conditions reservoir pressure



Herscher's dehydration equipment. These are silica-gel charged units; one can be activated while the other is on stream. The adsorbers are manually switched when a vapor-content recorder indicates that the moisture content in the outlet gas is above 4 or 5 lb per MMcf.



The five Fluor Fin-Fan units that supply cooling capacity for engine jacket water at the Herscher compressor station. Note the doors for controlling air flow through the units. Supply and return lines for the coolers are located overhead.



is adequate for delivery to the market and the compression facilities at the station are not required. Initial dehydration is accomplished at the wellhead and completed in Black, Sivalls & Bryson separator and adsorber units. Two such units have been installed and their piping arranged so that the silica-gel charge in one can be reactivated while the other is on stream. Because of the fluctuating demand characteristics of the Herscher project, a normal in-use and reactivation time cycle for the adsorbers (usually on stream 8 hours, off stream for reactivation for 6 hours, cooling for 2 hours, and then back on stream) is not practical. Instead, a Minneapolis-Honeywell vapor-content recorder is used on the adsorber output line, and when the water vapor content of the output gas is observed to be greater than 4 or 5 lb per MMcf of gas, the adsorbers are manually switched.

Gas source

The adsorber that is on-stream receives gas from either the field piping or the compressor station discharge line, as the case may be, through a separator. Gas enters the adsorber at the top and is dehydrated as it is forced down through the water-affinitive compound. From the adsorber, the gas is piped into a heat exchanger used to cool the hot output gas from the reactivation bed of the off-stream adsorber. From there, the delivery gas is sent to the pipeline that carries it to market.

About 10% of the flow gas is normally used in the reactivation process. The gas is bled off just upstream from the separator in the line that delivers gas to the adsorption units. During the reactivation process, the reactivation gas is heated to about 350° F with steam generated by two gas-fired boilers. The hot gas is then passed through the off-steam adsorber in a counter flow direction. Heat is transferred to the adsorbent bed and the water therein is vaporized to flow from the unit with the reactivation gas.

After leaving the adsorber, the saturated, hot reactivation gas passes to a cooler that is also a part of the adsorber installation, where it is cooled to about 10° to 20° F above flowing gas temperature. The cooling of the reactivation gas condenses a major part of the water vapor that it picked up in the charge bed. The gas then passes through a BS&B separator and then into the stream of gas flowing from the adsorber in service. The reactivation gas mixed with the dry gas from the adsorber in service is well within commercial limits.

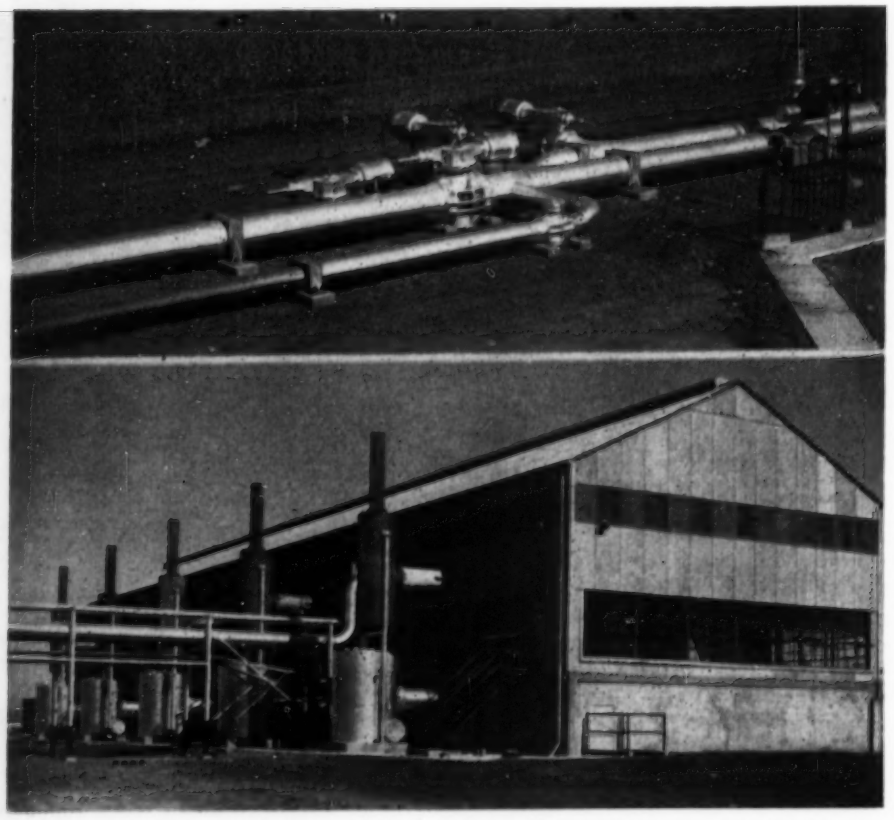
The all-important dehydration station at Herscher dome was designed by J. F. Pritchard Co., Kansas City, to specifications prepared by Natural Gas Storage Co.

Water treatment for domestic use, station steam generators, and compressor engines is accomplished by equipment situated in a separate building on the site. Water storage is provided by a 50,000-gal. elevated water-storage tank.

Station power

Station power, except that used for domestic purposes in the homes of station personnel, is produced on site by two 500-kva generators, driven by Cooper-Bessemer JSG8 engines. A gas engine-driven 5-kw generator is used as an auxiliary source of emergency electric power for station lighting.

The station is so designed that it may be taken out of operation and the piping blown down with a maximum of ease. Remote shutdown valve controls are located in the compressor area and the dehydration equipment area, and near the mainlines to and from the project. Operation of any of these valves will automatically close valves in the 30-in. line to and from the storage property and the line to and from the wells in the field, and blow down the system. The emergency shutdown valve operators are powered by gas pressure from the incoming line which is at mainline



View of valve operators and shutdown valves (upper photo) on station lines. To the right can be seen a blowdown stack equipped with a valve and its operator. Note the wire lines to concrete deadmen and the concrete foundation under the blowdown stack. These resist thrust and whipping forces of the jet effect when gas is exhausted at critical velocity. Jet effect equivalent to 16,000 hp (greater than any jet engine in existence) is not unusual. Foundations must be designed to support this reaction. Manual operation of the valves is provided at the installation on the edge of the walkway.

Exterior view of Herscher compressor station 201 (lower photo) showing American Air filters and Maxim silencers. Fuel and oil lines enter the station overhead.

pressure. Other station valves, including those used to convert the station from injection to supply cycle, are piston-operated valves that are actuated by gas pressure.

A 30-in. line serves as a feeder to and from the gathering lines that connect the wells in particular parts of the field. The gathering lines are of various sizes depending on the capacity of the section of the field they serve. A 10-in. valve and blowdown stack is located at each of the wells in the field.

OPERATION

The storage company started injection on April 1, 1953, and injection has continued, with certain interruptions, to date. At present, there is about 18 billion cu ft of gas in storage.

Storage gas appeared on Aug. 1, 1953, in wells completed in a partly depleted water stratum at a depth of about 200 ft. Several oil wells had been drilled into this stratum about 50 years ago and had been abandoned with improper plugging technique. The leaking storage gas, mixed with native marsh gas, began issuing from the old water wells and oil wells. Injection was stopped temporarily, and an intensive search was started to locate and repair the leak or leaks. All known detection techniques were used and several methods were evolved in an exhaustive searching program. Some leaks were located and corrected; this resulted in a curtailment of the total volume of leaking gas, but even today some sources of gas leakage remain. The search for a complete answer continues.

No explanation

No satisfactory explanation for the migration of relatively small volumes of storage gas from the Galesville sand up into the Galena and St. Peter formations has been found. Experts believe there are four possible ways for the gas to reach the shallow formations:

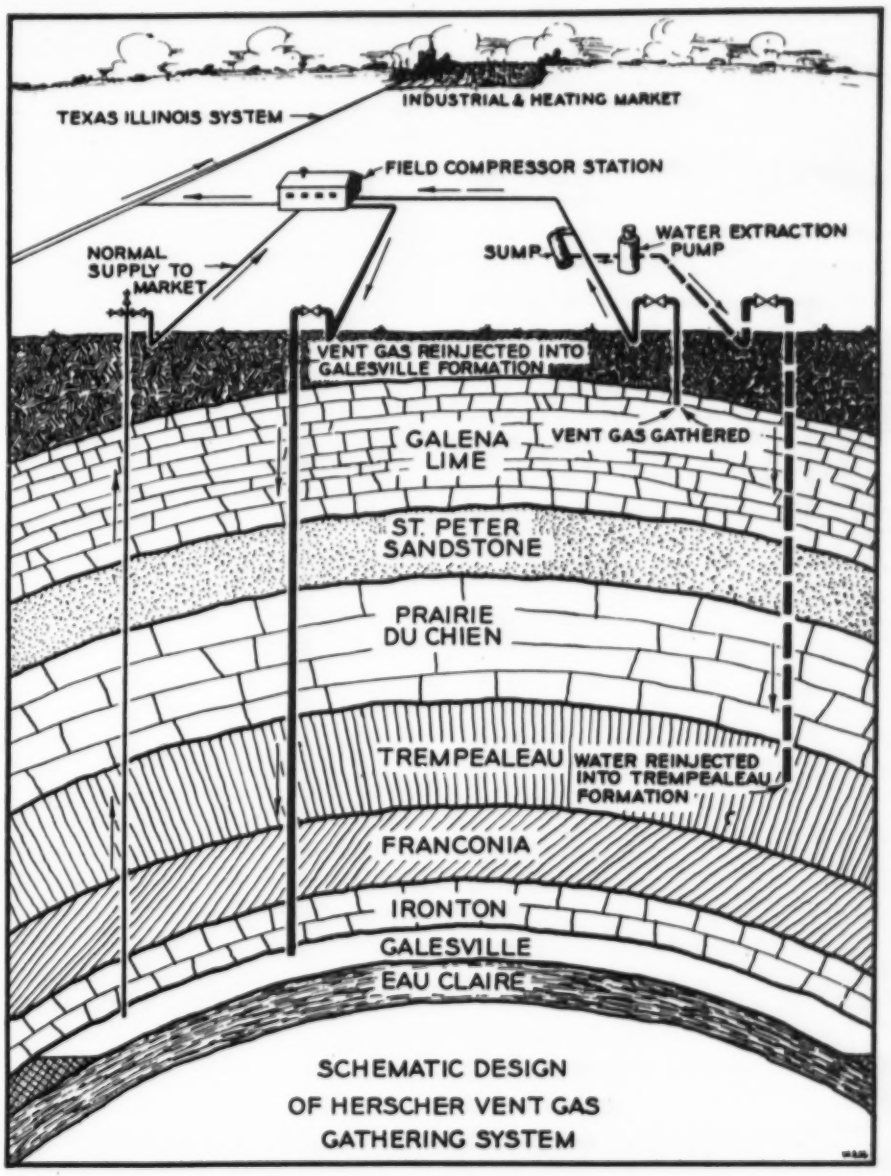
(1) Gas flows behind the casing of several wells,

(2) Flow through an old, unknown oil well drilled into the Galesville,

(3) Casing leaks opposite the shallow zones, and

(4) Unidentified minor faulting.

Pending the discovery of a method that will completely eliminate all leakage, Natural Gas Storage Co. of Illinois has been working on a leakage gas gathering system that will eliminate the gas losses. A pilot gathering system was constructed in December 1954 and its operation has since proven successful.



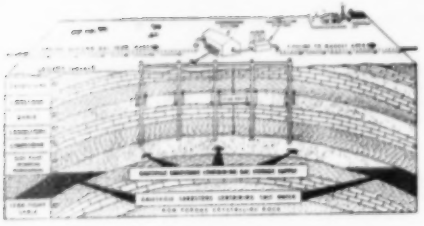
Artist's conception of the vent gas recycling system.

VENT GAS RECYCLING SYSTEM

The purpose of the pilot system is to gather the leakage or vent gas from wells (called vent wells) in the area of maximum venting, repressure it in a compressor, and reinject it into the Galesville storage stratum. Design of the system was complicated by the presence of sulfurous connate water in the Galena stratum. This water mingles with the venting gas and causes a problem as it must be separated from the gas prior to recycling. Another design consideration was the pressures involved in recycling the vent gas. The pressure of vent gas from the Galena formation is at 1 or 2 psig, while the pressure for reinjection to the Galesville sand may have a maximum requirement of 710 psig. This meant that a small 3-stage compressor would have to be installed.

Gathering system

A gathering system fabricated from 10-in., API-5L line pipe was connected to vent gas wells known as Karcher 0-4, 0-5, 0-7, D, F, H, I, J, L, and N. This



gathering system required about 2000 ft of 10-in. pipe. The gathering line carries vent gas to a drip that drains slugs of water (picked up in the Galena formation) from the gas stream into a reservoir made of 40 ft of 30-in. OD line pipe fitted with dished welding-heads at both ends. This sump has a 20-in. OD riser at one end to accommodate a sump pump that is driven by a gas-fueled engine. The drive clutch for this engine is actuated by gas pressure differential. The pressure gradient is provided by a Fisher Leveltrol control that is actuated by a float in the previously mentioned sump. Thus, water that is separated from the vent gas is pumped at a maximum rate of 300 gpm, a maximum head of 300 psig, through 4-in. galvanized iron piping to the Trempealeau observation well where it is injected into the Trempealeau formation for disposal. This formation was selected for disposal because of its ability to take large quantities of water at relatively low injection pressure.

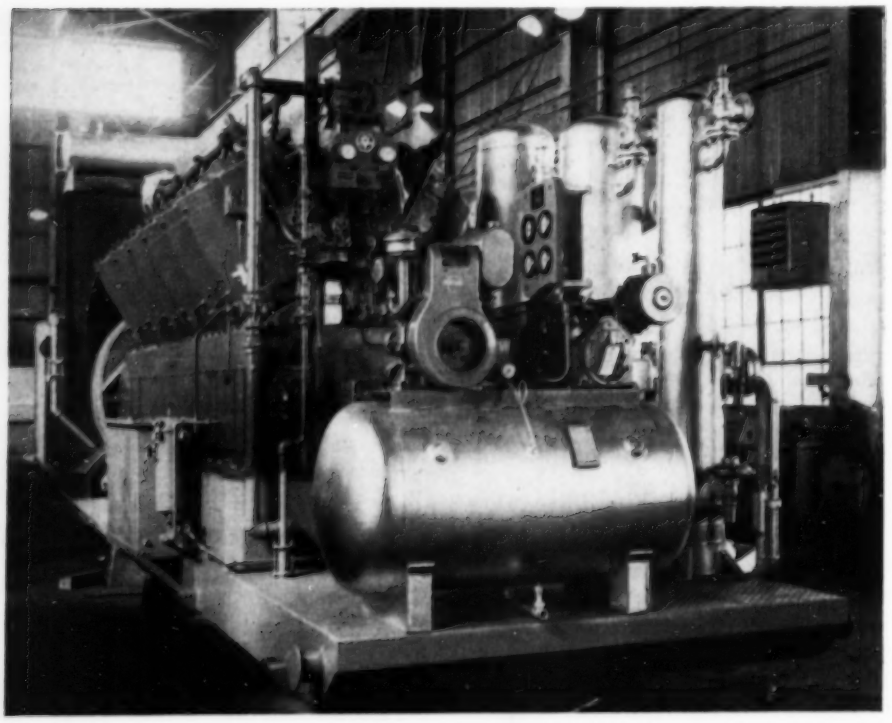
From the drip and the water removal process, the vent gas passes to a field compressor station where a packaged compressor is installed. The skid-mounted unit packaged by J. B. Beaird Co. has an Ingersoll-Rand, 660-hp SVG-12, three-stage compressor with all appurtenances including air compressor, jacket water coolers, etc. It is housed in a prefab steel building that has an opening in one end that provides exhaust for the Young radiator that furnishes cooling capacity for the compressor's water, oil, and throughput gas. The compressor housing is equipped with a small, vented space heater to guard against freezing temperatures inside the building when the compressor engine is not operating. The compressor discharge piping is a high-pressure 4-in. line that is tied into the field gathering system through which the gas flows to the various wells which are open for re-injection purposes.

Practical procedure

The vent gas gathering method used in the pilot system has proved out as a practical operating procedure. At the present time, approximately 2.6 MMcf per day is being recovered and compressed from a minimum of 1.4-in. mercury vacuum to a maximum of 710 psig and returned to its original storage in the Galesville sand. An hourly average of 1100 gal. of water is being separated and pumped into the Trempealeau formation for disposal. Oddly, the Trempealeau is, at this writing, acting as a syphon. This syphoning effect is created by the extreme rapidity with which the Trempealeau is dispersing the injected water. Actually, the pump is required to operate only when an unusually large slug of water is dumped into the sump by the drip to create an "overload" on the syphoning system. It is probable that this situation is only temporary.

The fact that Compressor Station 202, the pilot gathering system's packaged-compressor installation, is at times drawing a vacuum pressure on its suction side is significant. This would indicate that gas leaking into the Galena stratum is being produced from the vent wells at a rate that is faster than the time required for the vent gas to migrate (under the existing pressure gradient) from the periphery of drainage to the casing of such well. Several venting wells in the vicinity of those connected to the gathering system were shut in on a temporary basis to determine whether the suction pressure on the compressor's intake would increase. After these wells were shut in for four days, the suction pressure increased by about 1 psig and, of course, broke the vacuum.

Valuable data are being obtained from this pilot project. Interpretation and extrapolation of data that will be collected over a longer period may prove very useful in the determination of the location of the leakage path from the Galesville sand to the Galena limestone.



J. B. Beaird packaged compressor unit. Air compressor and tank in foreground supply starting air for the Ingersoll-Rand 660-hp SVG-12 engine.

Vent gas recovery

The successful operation of the pilot vent gas gathering system has furthered the design of a gathering system to recover venting gas from the entire Herscher venting area. Application has been made to the Federal Power Commission for approval of the full gathering and recycling operation. Tentative plans call for a design that will use the main Herscher compressor facility, Station 201. The gathering or compressor suction system will be tied into about 25 wells completed into the Galena formation and venting gas. These oil wells are being cleaned, and new casing is being run and set. The use of Compressor Station 201 will mean that two of the five 2000-hp Cooper Bessemer GMW compressor units will have to be converted to three-staging for repressuring the vent gas to injection pressure.

HERSCHER PERFORMANCE 1954 - 1955

Commercial operation of Herscher dome gas storage facilities was successfully started in 1954. The storage facility played a major part in increasing the peak day delivery capacity of the Peoples Gas system from 522 MMcf in 1951 to 1191 MMcf in 1954. This capacity was also available to 24 other gas utility customers of the pipeline companies.

Herscher has had its effect on the ability of Peoples Gas to permit the connection of new domestic space-heating loads; for instance, there were 81,000 such customers in 1951 in Chicago, and at the end of 1954 this service had been extended to 170,000 homes. There still remain, however, more than 100,000 residential customers on the waiting list for space heating. The other utility customers account for another 150,000 waiting list applicants for space heat.

The commercial feasibility of Herscher was substantiated during the year. Actually, 166.45 MMcf were withdrawn from the underground storage during one 24-hour period in February 1954. The total gas injected into the Galesville reservoir, less withdrawals for the accounts of customer companies, amounted to 18.8 billion cu ft as of Dec. 31 of last year.

The heating season of 1954-55 gave Herscher dome an opportunity to prove its worth. During two periods of subzero weather, Jan. 26-28 and Feb. 10-12, significant volumes of natural gas were taken from storage to supply the demands requested by utility customers.

Jan. 26-28 period

During the Jan. 26-28 period, a total of 301,122 Mcf was withdrawn at a maximum daily rate of 98,526 Mcf. The maximum hourly rate during the same period was 6245 Mcf. The minimum wellhead working pressure experienced during this heavy withdrawal was 637 psig while the minimum shut-in pressure of the observation well was 661 psig. The reservoir pressure had recovered to 668 psig by Feb. 10 when the second withdrawal period was necessary.

During the Feb. 10-12 period, approximately 224 MMcf of gas was withdrawn at a maximum daily rate of 128 MMcf, and maximum hourly rate of 7007 Mcf. The minimum working pressure and shut-in pressure observed were approximately the same as those for the previous withdrawal period.

During a 24-hour period on March 14 and 15, a measured volume of 434.8 MMcf of gas was withdrawn from the reservoir. This was a test withdrawal during which the minimum observed wellhead working pressure was 610.0 psig, and the minimum observed shut-in pressure was 657.4.

No difficulties

No operation difficulties were experienced during these severe tests. This is ample evidence of the success of the project as a whole and the storage system has proved its flexibility of operation under adverse conditions. Also, it demonstrated that Herscher has the ability to successfully send out relatively large volumes under short notice. The latter is, of course, of utmost importance to the customer companies.

PROJECTED EXPANSION OF HERSCHER

On Dec. 30, 1954 application was made to the FPC for approval of the following expansion projects for Herscher:

(1) A new pipeline to permit larger deliveries to the Texas Illinois pipeline near Joliet and thence to the market.

(2) An increase in the stored gas volume to be retained in the reservoir for "cushion" purposes.

(3) The installation of the complete vent gas gathering and recycling system.

The first expansion step contemplates the approval for storage volume increase to allow delivery from storage of 430 MMcf per day. This objective, in turn, will result in requirements for additional physical, aboveground facilities.

Studies indicate that the storage wells will be capable of delivering gas at a pressure of not less than 550 psig. Storage gas will probably have to be handled by three of the five installed engines as two have been committed for recycling the vent gas. It is likely that two compressor cylinders will have to be added to each of the three engines that will be used for injection and withdrawal purposes.

To deliver the highly increased withdrawals to the pipeline that are anticipated, it will be necessary to construct 31 miles of pipeline directly from Herscher storage to a tie-in plant at or near the south header of the present Illinois river crossing on the Texas Illinois system. Present design specifies the use of 36-in. pipe with 7/16-in. wall for this line.

At present, Texas Illinois Natural Gas Pipeline Co. operates a metering station at Joliet. The capacity of this station must be increased if both the storage company gas and Texas Illinois gas are to be handled. This will be a temporary situation, so it is planned to increase the capacity of the orifice meter runs by the installation of larger orifice plates and 100-in. orifice-meter gauges.

New metering station

It will also be necessary to measure just that gas which is taken from the field at Herscher; this will be done by the installation of another metering station close to the point of connection of the Texas Illinois and the storage lines. This, too, will be a temporary installation, for when the 36-in. line (from Herscher to the river crossing) is extended to Joliet, this meter will be reclaimed and permanently installed in a position through which storage gas will be metered for delivery to lines of the Chicago District Pipe Line Co., another Peoples Gas subsidiary, at Joliet, and to the Joliet-Volo line of Texas Illinois. The new 36-in. line, compressor conversion, additional dehydration equipment, and the metering equipment will require an estimated expenditure of $5,140,000 for construction. In addition, an estimated $1.5 million will be spent to add the complete vent gas gathering system previously described. ■

GAS Bibliography

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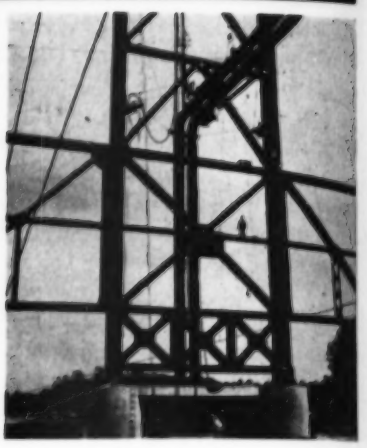
"Despite Leakage Difficulties, Herscher Storing 16½ Billion cu ft," February 1955, p. 140.

View of the crossing site. This site, near Grand Tower, Ill., was chosen because here the Mississippi is narrow and deep, and the relatively high banks on either side are underlain with limestone bedrock that affords an adequate foundation for the tower piers and main anchors.

The Illinois side concrete pier and structural steel tower. The twin risers in the 30-in. pipelines can be seen. Horizontal extensions to each side of the tower's columns are part of the wind guy arm (below).



Gas flows in twin lines across Mississippi river

NATURAL gas from the Texas Gulf Coast now hurtles the Mississippi river in twin 30-in. overhead-suspended lines as it flows to the Metropolitan Chicago market in the pipeline system of Texas Illinois Natural Gas Pipeline Co. The new suspension bridge—the world's longest pipeline suspension structure—stretches 3690 ft from centerline-to-centerline of anchorage, and has a main span of 2150 ft. Although it is now operational, some finishing touches will have to be added.

Design engineers

The bridge was designed by two San Antonio, Texas consulting engineering firms—Matthews & Kenan, and Mitchell & Hunt— to resist wind loads of 27 lb/sq ft on circular and convex surfaces, and 40 lb/sq ft on flat surfaces. Ice load design on the main cables was for 107 lb/lineal foot.

Two main piers were rested on bed rock, one on the Missouri side and one on the Illinois side of the crossing point between Grand Tower, Ill., and a point ¼ mile south of Wittenberg, Mo. The Illinois side pier was easily founded on bedrock by open cofferdam excavation to about 40 ft below existing grade line, but the pier on the Missouri side necessitated a 151-ft penetration to found on bedrock and this posed a major construction problem. A pneumatic caisson had to be used to get to that depth and at the same time exclude encroachment by the relatively high water table.

Open dredging was used for sinking the caisson on the Missouri side until the-120-ft level was reached. Water was excluded up to this point by the use of multiple deep wells to maintain a lowered water table. After the wells were plugged, pneumatic dredging started. The caisson was initially pressurized to 17.5 psig (with air) and was later increased to 48 psig. In operation, the sandhogs would clear out the spoil, then the air pressure would be reduced, and the weight of the caisson would sink it further into ground.

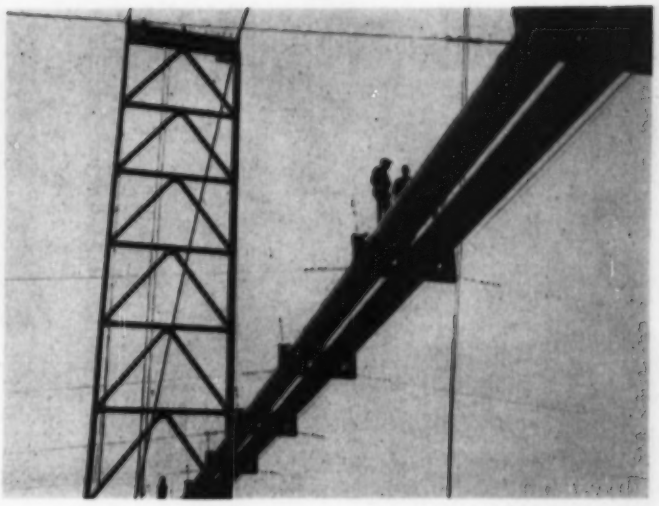
With the cutting edge of the caisson about 6 ft above the planned elevation, the interior of the working chamber wall and ceiling fractured, bringing an immediate halt to the work. The cutting edge was then underpinned to the bedrock with a 12-in.-thick concrete slab, poured in staggered sections beneath the perimeter of the cutting edge. After proper sealing with poured concrete pads to preclude encroachment by water and muck, the foundation was completed.

No unusual problems

Construction of the pier on the Illinois side was completed without any unusual problems. Main anchors were poured on both sides; each contains about 2500 cu yd of concrete and the main anchor bolts are 2¾ in. by 31 ft, while the bolts for the sway-bracing cables are 3¼ in. by 20 ft.

Structural steel towers that reach 263 ft above ground level support the two main cables that describe catenary curves between the two towers, with a

Anchor and rocker bent on the Illinois side. The main suspension cable clusters separate at the rocker bent and the individual cables are tied into anchor bolts. Rocker bent is the small, free-swinging tower in foreground.



View of the two 30-in. pipelines nested in their floor beam cradles. Small vertical cables are suspenders from the main suspension cable clusters. Horizontal cables tie in the floor beams with the wind guys. Pipelines are 115 ft about the river level.

165-ft drop in the catenary from the tangent points at the top of the towers. The main cables measure 3804.851 ft from face-to-face of the anchors and each is a cluster of 12 2-in.-diameter pre-stressed spun-wire ropes with a minimum ultimate tensile strength of 372,000 psi. The main cables break from the cluster at rocker bents, and each 2-in. cable is fixed to an anchor bolt.

The main cables were pulled across the Mississippi without interference with normal traffic. To accomplish this, a ⅜-in. wire rope messenger cable was pulled across the river on a barge. The messenger cable was reeled from a drum at the Illinois side anchor site, hoisted over the Illinois tower, carried across the river, and then hoisted over the Missouri tower before being carried to the Missouri anchor site. The messenger cable was then used to pull a 1⅛-in. wire rope from the Missouri side to the Illinois side where it picked up the first permanent cable and carried it back across the river.

Suspender ties

Eighty-five sets of main suspender ties drop from the catenary of the main cables to support the 85 floor beams that cradle the two 30-in. pipelines. The suspenders are ⅝-in. wire ropes, and the floor beams are set at 25-ft centers over the 2150-ft main span.

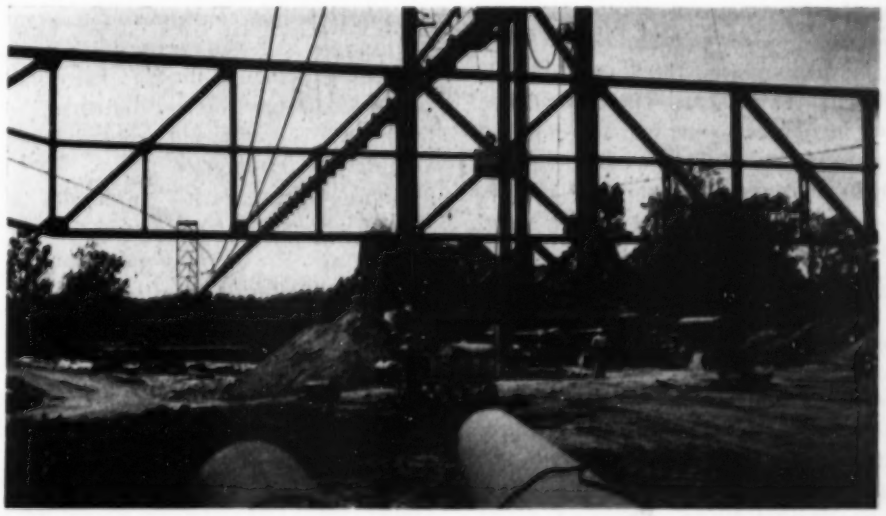
Twin wind guys, one on each side of the pipelines, stretch from two wind guy arms, one on each tower. This structural and cable assembly prevents lateral sway due to intermittent or continuous wind loading and terrestial disturbances. The wind arms are 330 ft in horizontal length and spread out the 2 main wind cables made from 2⅜-in. galvanized spun wire with an ultimate tensile strength of 522,000 psi. Five-eights-in. wind guy suspenders connect the pipeline floor beams with the wind guys.

Pipe lengths

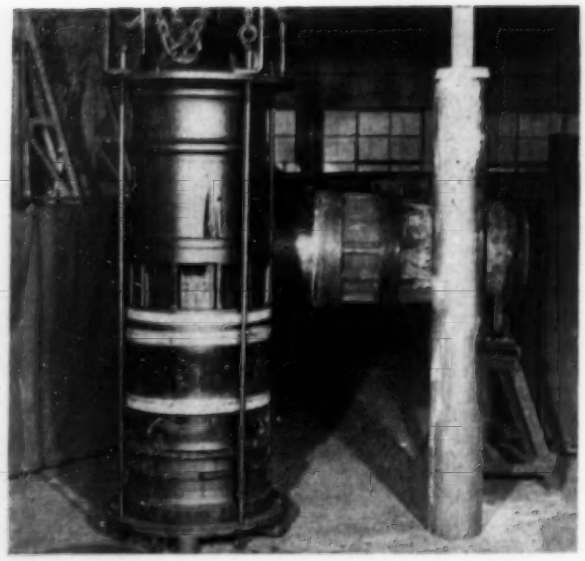
The pipe was handled in 80-ft lengths which were pushed out over the river, length after length. Welders then joined them into the completed pipeline segment from working perches about 115 ft above the waterline. Each welded joint was X-rayed to assure absence of flaws.

Existing lines

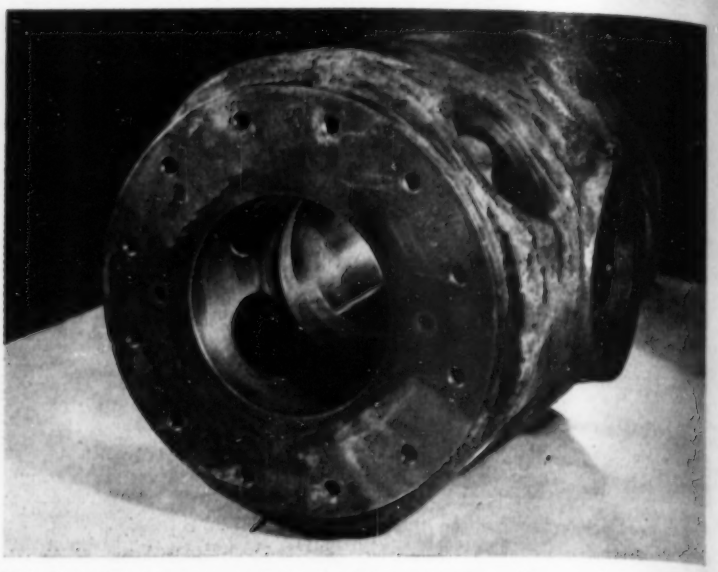
Should the overhead lines be out of service simultaneously for any reason, continuity of service is assured by three existing 20-in. underwater-crossing pipelines. The overhead crossing was constructed because it is not subject to the mechanical damage and river scour that often cause failures in underwater crossings. Also, leakage is easier to combat and general maintenance is more readily applied to overhead-type crossings; however, suspension bridges have a much higher first cost. ■



This construction view shows the entire 2150-ft span of the 30-in. lines. Note the designed catenary curves of the main and wind guy cables. Number and size of air compressors indicate that the bridge piping was being tested at the time picture was taken.



This 21½-in. bore engine cylinder, 0.133 in. oversize, was cleaned up by machining at .217 in., restored to standard size by applications of Vanderloy and Porus-Krome. Cylinder is shown in electroplating fixture with soluble steel anode at right.



This 11 x 33 compressor cylinder is shown after Porus-Krome plating of bore. As received, the cylinder had ring wear to 0.027 in. oversize plus scoring due to a frozen piston. Bore was cleaned up by machining at 0.056 in. Vanderloy and Porus-Krome electrodeposited to restore bore to design 11 in.

Newly developed porous chromium plating increases life of power cylinder liner

By **ROBERT M. TAYLOR** • Van der Horst Co. of America, Olean, N. Y.

MANUFACTURERS of gas engines and compressors place a great deal of emphasis on the fact that the lubrizing of power pistons and the bores of power cylinders prevents scoring and excessive wear when a compressor is new—and further that lubrizing makes spare power pistons and cylinders rust resistant. These advantages are attributed to the manner in which lubricants react on a lubrized surface. Lubricants placed on the lubrized surface spread rapidly, thoroughly "wetting" the surface and providing the best potential lubrication possible.

In the very acceptance of the inherent qualities of the lubrized surface lies a potential acceptance of Porus-Krome, another bearing surface phenomena that not only offers comparable advantages from the moment the compressor starts up until "break in" is effected, but also provides for an almost limitless extension of these advantages, contrasted with the life expectancy of the lubrized surface, which is limited to a matter of hours.

GAS exclusive

Porus-Krome, a porous, hard, and wear-, corrosion- and abrasion-resistant chromium, increases the life of the bores of power cylinders three to five times over that of cast iron and contributes to increased ring life and reduced lubricating oil consumption.

Porus-Krome is to chromium as stainless steel is to steel, a processed improvement of a basic material designed to meet the demands of specific applications. Consider the physical characteristics of chromium:

1. Hardness (approximately 1000 Brinell) which exceeds that of any other material available for cylinders; hardness throughout case and at high temperatures.

2. Low friction and low affinity for other metals, minimizing heat generated at the surface under boundry lubrication conditions.

3. Corrosion resistance, which reduces surface deterioration from the action of the products of combustion.

4. Abrasion resistance, which reduces surface deterioration from the impingment of impurities in combustion air.

In view of these qualities in contrast with what cast iron has to offer, one would certainly assume that chromium was the answer to all problems of cylinder wear. Unfortunately chromium as plated lacks one characteristic of an ideal wearing surface—and that is the ability to wet with lubricants. For more than 10 years after the development of the first practical commercial process for the electrodeposition of chromium in 1924, innumerable attempts were made to utilize chromium on the bores of power cylinders, but without success. Invariably piston seizure would result from the lack of lubrication between

the conventional type rings and the chromium-plated bore.

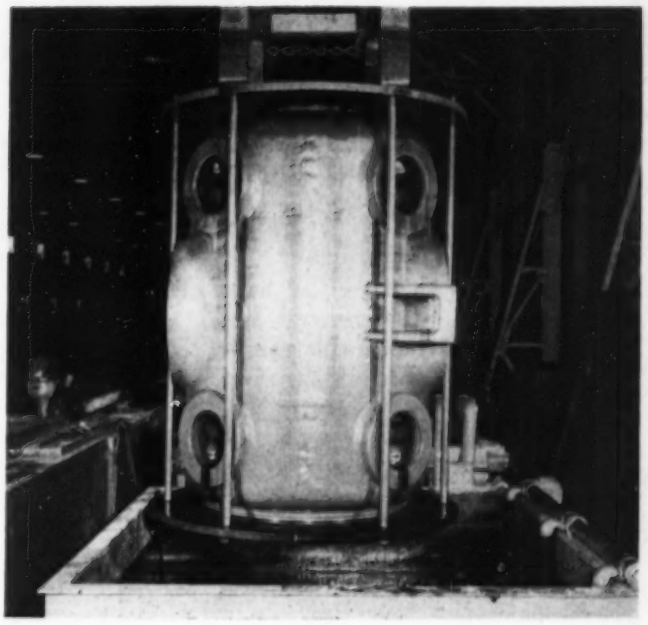
In the mid-thirties there were few individuals who retained any hope that chromium, with all its fine characteristics, could be ultimately used on the bores of power cylinders. Most notable of the few who continued research for a method to produce a chromium that would wet with lubricants was a Dutch scientist, Hendrik van der Horst. Like others, Dr. van der Horst had concentrated on attempting to change the surface structure of chromium by varying conditions in the chromium plating bath. The effects of temperature variations, changes in bath composition, and changes in current densities in the plating operation were all throughly investigated, but no appreciable increase in the potential wettability of the chromium surface resulted. At this point there appeared but one more alternative: to change the surface structure of the chromium after plating.

One surface characteristic of chromium as plated that appeared significant was that electrodeposited chromium had a tendency to check minutely at the surface. These checks are referred to as stress patterns, and temperatures maintained in the plating process will affect the depth and breadth of these checks to a relative small degree. Part of Dr. van der Horst's earlier work had been directed at enlarging these checks in the plating bath. Variation in the size of the checks had been effected, but not to an extent where a wettable surface resulted.

Stress patterns enlarged

Dr. van der Horst discovered that these stress patterns could be enlarged if current in the plating bath was reversed after the required amount of de position had been made. By controlling the reversal of current, chromium could be removed, not in even layers, but by an erosion of the existing stress patterns to any degree desired. Sensitive control will monitor chromium removal so accurately that the depth and breadth of the eroded pores and channels in the chromium can be predetermined. Subsequent testing and actual performance tests on engines has indicated that an ideally wettable chromium will result when 20 to 50% of the total surface area is represented by these pores and channels.

An additional advantage that a surface porosity of this order gives is relative to the engineering premise that factors producing heat on the bearing surface of a cylinder bore are speed, load, and the frictional characteristics of the opposing metals. Since the amount of friction depends in part upon the actual net area of contact (between piston ring and cylinder bore), obviously the reduced surface area of the Porus-Krome contributes to a reduction in frictional effects.



This 5-ton, 16½-in. bore compressor is shown on removal from waxing tank prior to Vanderloy plating. Active character of iron plating bath necessitates covering of non-plated areas with protective coating.

Reclamation application

From the standpoint of application, Porus-Krome is not limited to being used as "standard equipment" on the bores of power cylinders of engines of a number of engine manufacturers. As a reclamation application, Porus-Krome has been used to re-standard-size the bores of thousands of power cylinders. Operators of power equipment appreciate the advantages of operating equipment with standard size cylinders, pistons and rings, since in addition to reducing the number of spares required to maintain a number of identical power installations, there is no likelihood of mismating the components of power assemblies. The adoption of the standard sizing program recommends the establishment of centralized inventories of spare power assemblies that can be drawn upon from any point within a power distribution system without the chances for error in part shipments that exist in the disorganized atmosphere of tocks of various oversized part combinations.

Insofar as the electrodeposition of Porus-Krome is concerned new cylinders received from manufacturers and worn cylinders that have been removed from services are processed in an identical manner, with one exception. Engine manufacturers customarily provide new cylinders with honed bores. This eliminates the pre-plate honing operation that is required before the Porus-Krome is applied.

Cylinders received are first thoroughly degreased and then are passed to receipt inspection. Receipt inspection is the first in a number of inspections that account for the ultimate quality of the Porus Krome. Inspections are made before and after each step in the processing.

Preparation

Worn cylinders, including those that have been scored, are machined to true dimensions and then are honed to a mirco-finish. This type of preparation eliminates the possibility of ultimately having more than one plane of surface geometry on the chromium surface for the rings to oppose. If a piston ring opposes more than one plane of surface geometry it is a mechanical impossibility for the ring to seat properly.

After the honing operation the cylinder is placed in an electroplating fixture. The low tolerances ultimately required of a processed cylinder necessitate the fabrication of a special electroplating fixture for each cylinder type. In addition variations in bore diameter and length require individually tailored anodes that not only are dimensionally correct for any given cylinder type, but structurally adaptable

Chromium plating... Final operation is honing of the plated cylinder

to the variations that exist in the design of the electroplating fixture.

Electroplating fixtures for large power cylinders can assume large proportions and be of considerable weight. From the standpoint of weight alone a fixture for four 8-½ x 22-¼ cylinders of a certain type will weigh approximately two tons. Much of this weight is accounted for by the heavy copper busses attached to the fixtures that are required to carry the high current values demanded in the electroplating process. Current demands in Porus-Krome processing are 3 amps/sq in. of area to be plated. An individual 8-½ x 22-¼ cylinder fixture must conduct 1782 amperes.

Removing impurities

Once assembled in the fixture, the cylinder is placed in an etching tank for several minutes in order that any impurities existing on the bore of the cylinder will be removed. After etching the fixtured cylinder is placed in the chromium plating bath where it will remain until the required amount of chromium has been deposited on the cylinder bore. To depostit .010 of chromium on the bore of the 8-½ x 22-¼, the cylinder would remain in the plating tank for approximately five hours. During the deposition of the chromium, current enters the anode that is perfectly centered in the bore of the cylinder, flows through the chromic acid solution to the bore of the cylinder which is electrically cathodic. As the current flows from anode to cathode the chromium is deposited on the cylinder bore. Once the required amount of deposition has been effected, current flow is reversed and etching of the stress patterns on the plated surface takes place.

Final operation in the Porus-Krome processing is honing of the plated cylinder. The post-plate honing insures that the cylinder bore will be free of nodules of chromium that would interfere with the free travel of piston rings. In addition, any superficial porosity of a depth and breadth that would not be adequate for the storage of lubricants is eliminated by this honing operation.

Final inspection techniques used involve checks for hardness, porosity (by microscopic examination of the Porus-Krome surface) and dimensional correctness.

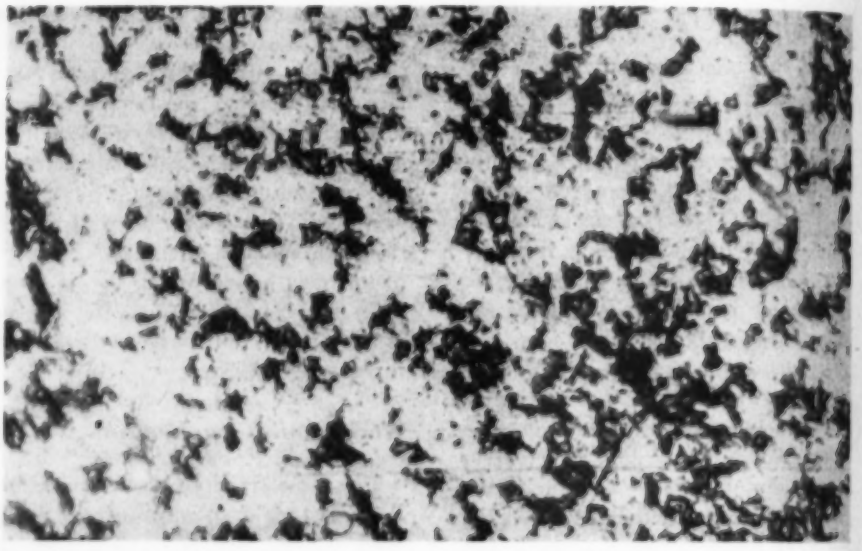
From an economic standpoint a deposition of .030 in. of Porus-Krome on the diameter of a power cylinder is practical. If it were not for Vanderloy, an electrolytic iron that can be utilized to complement the Porus-Krome, the operators of power equipment incorporating cylinders of large diameters, and consequently cylinders that would run to larger oversizes, could not economically re-standard-size. Vanderloy bonds atomically with the base metal of the cylinder to bring the bore back to standard size. Once restored to design bore dimensions, the bore in honed and Porus-Krome is electrodeposited.

Added life

The advent of Vanderloy has proven of immeasurable value to operators of power equipment that has reached an age where it is impossible to find spare power assemblies. Specifically compressors of the type manufactured 40 and 50 years ago by Westinghouse, National Transit, Turner, with many years of potential life may have to be scrapped because the power cylinders have been bored to the last possible oversize. The alternative of obtaining special castings of these cylinders is far from being economically practical.

Design dimensions

Vanderloy assumes a prominent role in reclamation applications where scoring of the cylinder bore has been to such a depth where clean-up of the bore by machining might not be possible for several hundred thousands. In addition fit surfaces on connecting rods have been satisfactorily returned to design dimensions by Vanderloy and, further, Vanderloy has a potential application on any surface where the tensile strength of low carbon steel has application.



Porus-Krome surface magnified 100 times. Note infinite number of pores that are potential oil reservoirs.

In view of the fact that most power installations in the gas industries are comparatively low in speed per unit horsepower, these industries necessarily have the highest investment per cylinder. Although low speed operation is a factor in favor of long cylinder life, an increase in the life expectancy of cylinders is an important economic factor. The installations that are operating on sour gas are in especial need of a wearing surface that will resist the attack of the by-products of combustion of this fuel. In this instance the fact that chromium resists corrosive attack in order of three to one over the resistance of cast iron is a decided recommendation for the adoption of Porus-Krome as standard in gas engines. ■

The code in Washington State
An editorial

By J. FRED EBDON • Managing Editor

As contractors' spreads start major construction on the transmission line designed and being built by Fish Northwest Constructors Inc. to introduce natural gas into the cheap-fuel starved Pacific Northwest area, the Public Utilities Commission in the state of Washington is considering testimony offered in public hearing concerning the promulgation of rules and regulations for the construction and operation of natural gas pipelines within the state, consistent with the interest of public safety. The conclusions reached and the regulations imposed by this commission will have a marked effect on operating companies that will be distributing natural gas in the Pacific Northwest next year, the Pacific Northwest Pipeline Corp. and any other natural gas transmission company that subsequently proposes to operate in the Pacific Northwest, and the entire gas industry. Why the widespread concern? Because this is the first over-all stepping stone or test case for the gas industry's own safety code—ASA B31.1.8—1955, Gas Transmission and Distribution Piping Systems.

Senate bill

This spring, the state legislature of Washington included provisions in Senate Bill No. 98 that empowered the PUC to set down rules and regulations that will be designed to protect the public safety by providing standards for constructing and operating pipelines engaged in the transmission of natural gas. The Washington PUC held open hearings on June 28-30 to glean opinions from experts in the natural gas pipelining field as to desirable provisions that should be included in their "code." Among those offering testimony were:

Fred Hough, Bechtel Corp., San Francisco, as an expert from the gas industry.

F. S. G. Williams, Taylor Forge & Pipe Works, as an expert from the gas industry.

Tom Jenkins, Fish Services & Management Corp., as an expert from the gas industry.

Roderick Stevens, Oil Heating Institute, representing that agency. Also a Mr. Johnson, an engineer from the Oil Heating Institute was heard.

John Mork, New York, a retained expert for the state. Mr. Mork was prominent in the formation of similar rules and regulations by the State of New York and is generally considered proficient in this field, though not considered by all of the gas industry as a thoroughly experienced pipeliner.

Hearing

The hearing did not produce any serious question of the structure of the ASA B31.1.8 Standard or its companion code ASA Z21.30, Installation of Gas Piping and Appliances in Buildings; however, it was recognized, and it certainly has been previously recognized, that the subject code(s) do not provide specific administrative provisions or set-up rules for their enforcement and execution. Frankly, based on the collective experience of the states where natural gas producing and cross-country pipelining have reached the highest order of the arts, we see no need for the creation of enforcement and execution mechanics--the distribution and pipeline companies have policed themselves in a manner that clearly indicates their desire to promote safety far beyond the efforts of any political subdivision, but it is not our purpose to quarrel with the State of Washington on this specific point.

We do want to point out that in Oklahoma, Louisiana, Texas, and a number of other states, the ASA B31.1.8 standard has been administered under the self-stewardship of the operating gas companies to the point where natural gas service is considered by the public enjoying its benefits as safer than other regularly distributed fuels or energy sources. Statistics, for what they are worth, will bear out this confidence placed in natural gas companies and the fuel by governing bodies and the public.

The Code for Pressure Piping, ASA B31.1.8—1955, Gas Transmission and Distribution Piping Systems was produced from exhaustive work by experienced leaders in the field of gas technology and is the product of their many, many years of experience in the gas industry. Never before was there assembled such an astute group of experts within the science of gas engineering. It is the gas industry's own effort in the interest of public safety—it can stand on its own merits because it is based on *uniformity* and *sanity* for the good of public safety and gas facility construction and operation regardless of geographical location. It is not a perfect code—there is no such thing. All of the committee members who worked on its several drafts will not agree on particular recommendations. These same men might not agree on specific points in the Bible (another great code) or on an interpretation of the Constitution of the United States, but our (the gas industry's) code was formed through the American system of compromise by the few for the good of all. Again, it will work in the Pacific Northwest—it has worked in other sections of the country.

Benefits

An area benefits industrially when a cheap energy source is introduced within it. It is obvious to us that Pacific Northwest Pipeline Corp. has negotiated with Fish Northwest Constructors to build the natural gas pipeline into the expanding Pacific Northwest for one simple purpose, i.e., to market their product at a price that will produce economy to consumers. If they can't sell the gas on an energy and utilization basis that will result in savings through its use, they might as well leave the gas in the San Juan basin. In their design of the line, they have to make the compromise between ultimate, absolute safety and economic feasibility. This they are able to do by compliance with the ASA Standard and designing on the basis of calculated safety factors where the code does not spell out details. In this way design conforms with recognized standards and practices within the industry and assures an efficient pipeline, which, in turn, assures pay-out on the venture. The foregoing considerations apply equally to any pipeline company that can or will operate within the area.

The code in Washington State

(Continued)

Consider this: If a long distance gas transmission pipeline should be forced to change pipe wall thickness, provide variation in pipe chemistry, reduce or increase protective coating thickness, swing away from highways by a different dimension, etc., every time it crosses a state line, there would be major increases in cost introduced into purchasing contracts, construction techniques, and operating factors. The line might become an inefficient pipeline or even impractical to construct. As people in the Pacific Northwest should know, the federal government is about the only major heavy investor that has shown a consistency for plowing money into uneconomical ventures. Natural gas pipelines do not enjoy a great deal of government subsidy; on the contrary, they put quite a bit of money into the source from whence come these subsidies.

Prosperity

There can be little doubt but what the arrival of natural gas to Oregon, Idaho, Washington, et al, will be a shot-in-the-arm to an area that is already having growing pains. We feel it will be the needed backbone to further increased prosperity in that area. We urge that area to adopt provisions of uniformity and sanity for all requirements dealing with design, construction, and operation of natural gas systems for the good of all concerned.

Right now, Oregon's Legislature has recommended "standards" tabled, and Idaho has such legislation waiting. Washington will announce the recommendations of its PUC soon, and in 20 days following there will be further public hearings to contest the findings, if necessary.

Uniformity and sanity

Thus, the eyes of the Pacific Northwest, along with the eyes of the nation's gas industry, focus upon the PUC in the State of Washington. Now is the time to adopt uniformity and sanity—may we repeat—uniformity and sanity in natural gas operations as exhibited by the valid provision of the ASA B31.1.8—1955 Standard and the administrative procedures formulated by the area's gas companies. Rely on the experienced, conscientious engineers and managements of the gas industry—accept their safety code—many eyes turn to the State of Washington for leadership.

GAS new pipeline products

(For additional information, use coupon on page 65.)

23 Manual Reset Valve

Black, Sivalls & Bryson Inc. has introduced the Type 73-20 manual reset valve for emergency safety services requiring quick, positive action. Combining simplicity of design with positive action, the valve has many application: It may serve as a safety shutoff in either liquid or gas fuel lines, as a safe open valve for steam or foam fire snuffing systems, or to shut down pipelines that indicate a line break by loss of pressure.

The Type 73-20 utilizes bodies, trim, and topworks of BS&B diaphragm control valves with delatching trip mechanism to provide any usually specified safety requirement, with such response remaining effective until manually reset.

Black, Sivalls & Bryson Inc.

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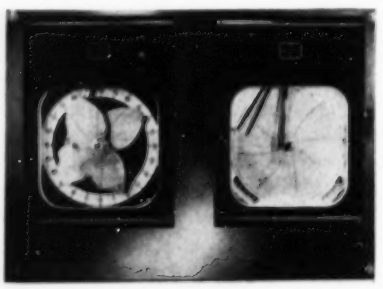

24 Combination Controller

An instrument that combines in a compact two-case unit a two-pen, two-cam time program controller with a cycle controller that times up to eight operations has been announced by Bristol Co. The cases can be mounted side by side or one above the other.

The time-program controller can be used to control two variables such as temperature, humidity, pressure, or vacuum through any predetermined program of values by means of an aluminum cam cut to the proper shape.

At the same time, such operations as the opening and closing of valves, switches, and dampers, and the starting and stopping of motors, pumps, and blowers can be automatically timed by the cycle controller.

Bistol Co.

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25 Clamshell Attachment

Ottawa Steel Inc. has added a clamshell attachment to its industrial heavy duty backhoes. The attachment features down pressure, forward pressure, or up pressure as desired. The operator can actuate either side of the clamshell individually or both sides simultaneously.

Another feature is the automatic ejectors in both sides of the clamshell, insuring full dumping of wet, sticky clay or other material. At full opening, the clamshell will dig a 30- by 44-in. hole straight down to a depth of 6 ft; a 30- by 66-in. hole for 8½ ft; and a 30- by 88-in. hole to a depth of 11 ft.

Ottawa Steel Inc.

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26 Engine Wear Meter

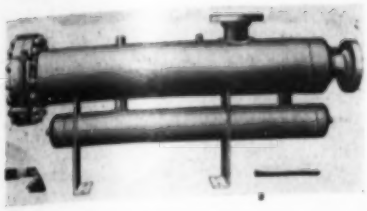
A new engine wear meter has been announced by the Gerin Corp. It is a gauge permanently attached to any engine and claims to warn the operator when there is fuel dilution, water or antifreeze leakage, running on dead filters, wrong grade make-up oil and the like.

The meter responds to any increase or decrease in viscosity. This meter, according to the manufacturer, does not respond to the normal thickening or thinning of the oil incidental to varying operating temperatures. Hot or cold, the indicating hand points only to true and permanent changes.

Accuracy within 1% is claimed. The internal movement does not vibrate when the instrument is subjected to vibration and shock. Installation takes 30 minutes on any engine.

The Gerin Corp.

new products • *Cont'd.*



27 Scrubber-Filter

Perry Equipment Corp. has introduced a new scrubber and filter designed to remove micron size particles from gas stream under pressure. The filter employs replaceable fiber glass elements which will remove particles in sub-micron size ranges. It can be operated for long periods without attention.

In addition to being useful for filtering gases, the filter will remove fine mist particles by coalescing them into larger particles that can be removed by means of a conventional mist eliminator, which can be furnished as an integral part of the filter.

Perry Equipment Corp.

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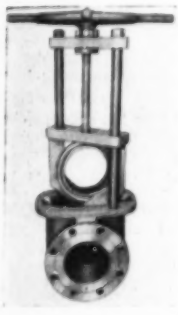
28 Valve



A new valve that incorporates the impenetrable sealing action of a line blind with the simplicity of operation found in a gate valve has been placed on the market by Hamer Valves Inc. Appropriately named the Visible Wedge, this new Hamer valve is designed to permit full view visibility of the wedge at all times. One glance is all that isrequired to determine whether the line is full open or closed. The precision metal-to-metal fit of the wedge and seats, augmented by dependable seal rings, provides a foolproof line shut-off.

In addition the valve seats are an integral part of the body. Both the wedge and the valve seats have stainless trim, which forms an impervious barrier to corrosion.

Another outstanding feature of the new Hamer visible wedge is its safety of operation. The operator has complete control of the wedge at all times. The wedge rotates at a touch. There is no lifting necessary by the operator to reverse the wedge.

Hamer Valves Inc.

29 Pipeline Ditcher

Gar Wood Industries Inc. has introduced a new pipeline and utility ditcher, the Buckeye Model 308, which has been designed for digging cross-country ditch and for city gas, water, oil, etc., lines. It digs to a maximum depth of 5 ft 6 in. with optional width of cut varying from 16- to 32-in. increments.

A live hydraulic wheel hoist provides fast and accurate positioning of the digging wheel. Soil discharge conveyor shock damage is eliminated by a hydraulic drive. Hydraulic drive for soil discharge conveyor is completely controlled from the operator's seat.

The Buckeye 308 has 16 digging speeds forward. Excavator wheel speeds and traction speeds are entirely independent of each other.

Gar Wood Industries Inc.

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30 Fire Equipment

Underwriters Laboratories Inc. has granted approval to the dry chemical piped system of fire extinguishment developed by Ansul Chemical Co.

With this system, automatic fire protection is provided against Class B and Class C fire hazards by means of dry chemical, which is conveyed through pipes and expelled in the area surrounding the hazard. Dry chemical piped systems can be installed to protect paint dip tanks and spray booths, ovens, driers, oil quench tanks, flammable liquid pumping stations, transformer vaults, diesel and gasoline engines, generators, oil storage tanks, flammable liquid storage rooms, asphalt saturators, and marine hazards.

The systems provide for either automatic or manual operation and can be activated at the system or from a remote control installation.

Ansul Chemical Co.

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GAS trade literature

31 Drillers Handbook

"Drillers Handbook on Rock," a 68-page pocket-size booklet containing a complete description of all common rocks, has been issued by Davey Compressor Co. In addition to detailed discussion of rocks, the booklet tells how to judge the speeds with which various rocks can be drilled and presents a method by which the driller can establish a "point system" to figure drillability and drilling cost.

Davey Compressor Co.

32 Compressor Bulletin

The latest V-angle engine-driven compressor is described by Cooper-Bessemer Corp. in its 24-page engineering bulletin (No. 76). Tme bulletin provides technical data on the latest developments in compressor design for further improving fuel economy and increasing capacity and range operation.

Cooper-Bessemer Corp.

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33 Fire Fighting Bulletin

Two articles of apparel for fire fighters are described in a new bulletin (No. 1301-3) from Mine Safety Appliances Co. One garment is the MSA approach-type fire protection suit made of a fiber glass fabric. The other is the MSA A-1-A fire fighter's hood, a separate unit for face, neck, head, and shoulder protection against extreme heat.

Mine Safety Appliances Co.

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34 Compressor Bulletin

A new bulletin on centrifugal compressors for natural gas transmission has been issued by Worthington Corp. A two-page diagram is used to illustrate 13 major design features of the centrifugal compressor with centerline support. An outline drawing is also presented along with information on the lubricating and sealing system.

Worthington Corp.

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35 Rod Finder Guide

A new 16-page "Rod Finder Guide" (TIS 1126) from Eutectic Welding Alloys gives welding and plant foreman who plan and lay out work a helpful source of "the right rod for the right job." The booklet covers rod and flux as well as electrode recommendations for torch and metal arc joining and overlaying of all base metals.

Eutectic Welding Alloys Corp.

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36 Engine Bulletin

Ingersoll-Rand has released a 20-page bulletin describing features of its Type S and SS heavy duty diesel engines, ranging in sizes from 375 to 1000 hp. In addition to information about the lubrication, cooling, and fuel injection systems of the engines, the bulletin (Form 10,040) includes specifications and dimension sections and a

trade literature • *Cont'd.*

number of illustrations of the engines and component parts.
Ingersoll-Rand Co.

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37 Metal Product Bulletin

Fluor Corp. has published a 15-page bulletin describing its fabricated metal products, including pressure vessels, prefabricated pipe, and welded structures. The bulletin contains many illustrations and specifications.
Fluor Corp. Ltd.

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38 Zinc Booklet

American Zinc Institute has published a 32-page illustrated booklet entitled "How Zinc Controls Corrosion." Drawings, charts, and photographs together with brief comments present the corrosion control characteristics of zinc coating, zinc pigments, and zinc anodes.
American Zinc Institute

GAS progress reports

NEW CONSTRUCTION PLANNED

MONTANA - DAKOTA UTILITIES CO., Minneapolis. Docket G-8767 and 8843 for 30½ miles of new line and 540 hp in compressor capacity in Harding and Butte counties, S. D., and Fallon county, Mont.; 9 miles of line near Rapid City, S. D.; and 550 hp addition to station in Hot Springs county, Wyo.

OHIO FUEL GAS CO., Columbus. Docket G-8752 for 19 miles of line and a new metering station in north Central Ohio.

PACIFIC GAS & ELECTRIC CO., San Francisco. To build 189.8 miles of 34-in. pipe adjacent to Super Inch line between Topock, Ariz., and Milpitas, Calif. and add 12,500 hp at two compressor stations.

TEXAS GAS TRANSMISSION CORP., Owensboro, Ky. Docket G-8828 for 189 miles of line and 20,270 hp in compressor capacity along its system in Louisiana, Arkansas, Mississippi, Tennessee, Kentucky, and Indiana.

CURRENT CONSTRUCTION

ARKANSAS LOUISIANA GAS CO., Shreveport. Docket G-2307 for 134 miles of 6⅝- to 24-in. line in 11 sections, and 10,500-hp compressor station on its system in Arkansas, Louisiana, and Texas. Compressor station and 71 miles of line completed.

ATLANTIC SEABOARD CORP., Charleston, W. Va. Docket G-6500 for 84-mile, 26-in. line paralleling Cobb (W. Va.)-Baltimore (Md.) line in West Virginia, Virginia, and Maryland, and 2000 additional hp at Cleveland station in Upshur county, W. Va. Williams-Austin Co. working on 31 miles in Brafton, Upshur and Randolph counties, W. Va.

COLORADO INTERSTATE GAS CO., Colorado Springs. Docket G-2121 - (1955 program) 385 miles of 22-in. line from Denver to connection with proposed Pacific Northwest Pipeline Corp. line at Green River, Wyo.; with 4400-hp compressor station near Green River. Houston Contracting Co. began construction June 15; 135 miles of 22-in. to be completed this year; remainder in 1956.

EAST OHIO GAS CO., Cleveland. A 113-mile, 30-in. pipeline to serve Cleveland area from point just south of Toledo. Construction started April 15. Completion date: Oct. 1.

MANUFACTURERS LIGHT & HEAT CO., Pittsburgh. Docket G-2193 for 72 miles of 20- and 16-in. line, 38.7 miles of storage and well lines, 2 measuring stations and a 1760-hp compressor station at the Victory storage field in Marshall and Wetzel counties, W. Va.

MANUFACTURERS LIGHT & HEAT CO., Pittsburgh. Docket G-2289 for construction of 75½ miles of 10-, 12-, 24-, and 26-in. lines and 4400 in new and additional compressor facilities in Washington, Allegheny, Chester, Lancaster, and Adams counties, Pa., and Marshall county, W. Va.

MANUFACTURERS LIGHT & HEAT CO., Pittsburgh. Docket G-2479 for 61 miles of line and 1760 hp in compressor capacity on its system in Ohio, Pennsylvania, and West Virginia.

MICHIGAN GAS STORAGE CO., Jackson. Docket G-6501 for 36-mile 16-in. line and 3300 hp addition at Freedom compressor station in Michigan. Line would extend from Mt. Pleasant Junction to Milwaukee Junction. Work on compressor started May 16. Bechtel Corp. to start July 1 on line.

PACIFIC GAS & ELECTRIC CO., San Francisco. An 18-mile, 12-in. line in Colusa and Glenn counties to bring gas into Sacramento valley from two new fields. September completion.

PACIFIC NORTHWEST PIPELINE CORP., Houston. Docket G-1429 for 1466 miles mainline; 380 miles of spur and lateral lines; and 16 compressor stations totaling 104,420 hp, to extend from Ignacio, Colo., in the San Juan basin, to Bellingham, Wash. (Seattle area). Fish Northwest Constructors Inc., builders of the line, have let contracts to River Construction Corp., R. H. Fulton & Co., Associated Pipeline Contractors, A. J. Curtis Construction Co., B. & M. Construction Co., Midwestern Constructors Inc., for first 655 miles.

PANHANDLE EASTERN PIPE LINE CO., Kansas City, Mo. Docket G-2433 for construction of 294.5 miles of mainline loops, 106.3 miles of lateral loops, and 4750 additional hp. The 294.5 miles located in Kansas, Missouri, Illinois, Indiana, and Ohio were constructed in 1954 and are being operated under a temporary FPC permit. Remainder of work is being held in abeyance until approved by FPC.

SOUTH GEORGIA NATURAL GAS CO., Birmingham, Ala. Docket G-1915 for 368-mile, 12¾-in. line beginning at connection with Southern Natural line in Lee county, Ala., extending southeast to serve new communities in Georgia and Florida. Expected completion date: September 1955.

SOUTHEAST ALABAMA GAS DIST., Birmingham. A "U" shaped system of about 330 miles to serve 24 communities in southeastern Alabama from connections with Southern Natural. About 80% completed. Scheduled for completion in September.

TENNESSEE GAS TRANSMISSION CO., Houston. Dockets G-2310, G-2330 and G-2331. Construction has begun in Pennsylvania on a 243- mile, 24-in. line from Hebron (Pa.) storage field to Greenwich, Conn., and on an 18-mile 24-in. Hebron to Harrison storage field plus 62 miles of 26-in. loop in Ohio. Development of two more storage fields—Colden near Buffalo; Harrison, in Potter county, Pa. Construction is underway at Isola, Miss., and at Morhead, Ky. on new compressor stations. Later this year company will construct 370-mile, 30-in. line from Agua Dulce, Texas, to Kinder, La., along Texas and Louisiana Gulf Coast line (Docket G-8215).

TEXAS EASTERN TRANSMISSION CORP., Shreveport, and **NEW YORK STATE NATURAL GAS CORP.,** Pittsburgh. Docket G-2784 to construct field pipelines to connect up additional wells in Murrysville pool; acquire 2000-hp field gathering compressor station; and install 1980-hp station. New York State will operate facilities.

TEXAS GAS TRANSMISSION CORP., Owensboro, Ky. Docket G-6854 to lay 77.14 miles of partial loops in 7 sections between Covington, Tenn. to Jeffersontown, Ky.; 74 miles, 12-in., 35 miles 10-in., and 5 miles, 8-in. between Hardinsburg, Ky. compressor station and Columbus and Bedford, Ind.; to construct 26-in. crossings of Tennessee and Cumberland rivers in Kentucky and dual 12-in. crossings of Ohio river near Hardinsburg, Ky.; to build 4500-hp station at Columbia, La., and to add 4000 hp at Greenville and Clarksburg, Miss.; 2000 hp at Lake Cormorant, Miss., and 1500 hp at Covington, Tenn. H. C. Price Co. to lay 26-, 12-, 10-, and 8-in. lines (except river crossings); Houston Contracting Co. to lay 20-in.; Pentzein Inc. to lay Cumberland, Tennessee and Ohio river crossings.

TRANSCONTINENTAL GAS PIPE LINE CORP., Houston. Docket G-4185 for 360 miles of 36- and 30-in. line paralleling sections of system in nine states. Would include two river crossings; one 3000-hp and one 7500-hp station and miscellaneous additions to present stations. Contracts let to O. R. Burden Construction Corp., Associated Pipe Line Contractors Inc., Midwestern Constructors Inc., Houston Contracting Co., Western Constructors, Panama-Williams Co.

TRANSCONTINENTAL GAS PIPE LINE CORP., Houston. Docket G-2367 for 173 miles of 30- and 36-in. loops to parallel sections of existing system in Louisiana, Mississippi, Alabama, Georgia, North and South Carolina, Virginia, and Maryland, plus 46 miles of 12-in. and 16-in. loops and 12-mile, 24-in. extension of mainline in New Jersey. Contracts let to O. R. Burden Construction Corp., Midwestern Constructors Inc., Panama-Williams Co., Williams Brothers Co., and Associated Pipe Line Contractors Inc.

CONTRACTS LET

AMERICAN LOUISIANA PIPE LINE CO., Detroit. Docket G-2306 to construct 1289 miles of line—30-in. from North Tepetate, Acadia parish, La., to connect with Michigan Consolidated facilities near Detroit; 24-in. to feed into 30-in. line in Louisiana, also three 10,000-hp compressor stations. Not included is the 117-mile, 22-in. line to extend from Payne, Ohio, to Bridgman, Mich., to connection with Michigan Wisconsin Pipe Line Co. H. C. Price Co. and Houston Contracting Co. have contracted for 783 miles of the line.

TEXAS EASTERN TRANSMISSION CORP., Shreveport. Docket G-2503 for 481 miles of line, 86,900 hp in new compressor stations, and 36,020 hp additions at existing stations—all to be located in Texas, Louisiana, Mississippi, Tennessee, Kentucky, Ohio, Pennsylvania, and Alabama. Project would include a 382-mile line from Beaumont, Texas, to Kosciusko, Miss. The following contracts have been let: Houston Contracting Co., 59 miles; Tulsa Williams Co., 118 miles; H. C. Price Co., 134 miles; H. B. Zachry Co., 64 miles. Brown & Root Inc. will construct the compressor stations.

APPROVED

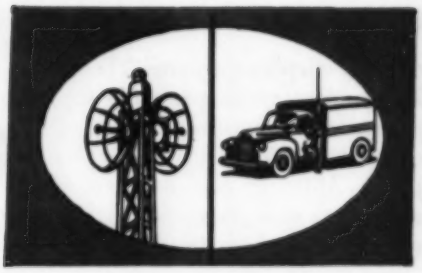
CITIES SERVICE GAS CO., Oklahoma City. Docket G-8571 and 8572 to install 39 miles of replacement line in Newton, Lawrence, Lafayette, and Johnson counties, Mo., and Johnson county, Kan.

CLINCHFIELD COAL CORP., Dante, Va. Docket G-7586 for 16-mile 12-in. line to transport gas from Dickenson county, W. Va. to Osborne Gap, Ky. for Kentucky-West Virginia Gas Co.

NEW YORK STATE NATURAL GAS CORP., Pittsburgh. Docket G-8568 for 21 miles of line paralleling section of line in Wyoming and Livingston counties, N.Y. to complete looping of line from Potter county, Pa. to near Caledonia, N.Y.

TRUNKLINE GAS CO., Houston. Docket G-8664 and G-8665 for eight new compressor stations in Texas, Louisiana, Mississippi, Tennessee, and Illinois totaling 56,000 hp; and 24 miles of line paralleling existing system in Texas.

communications



By FRANK CHAPMAN

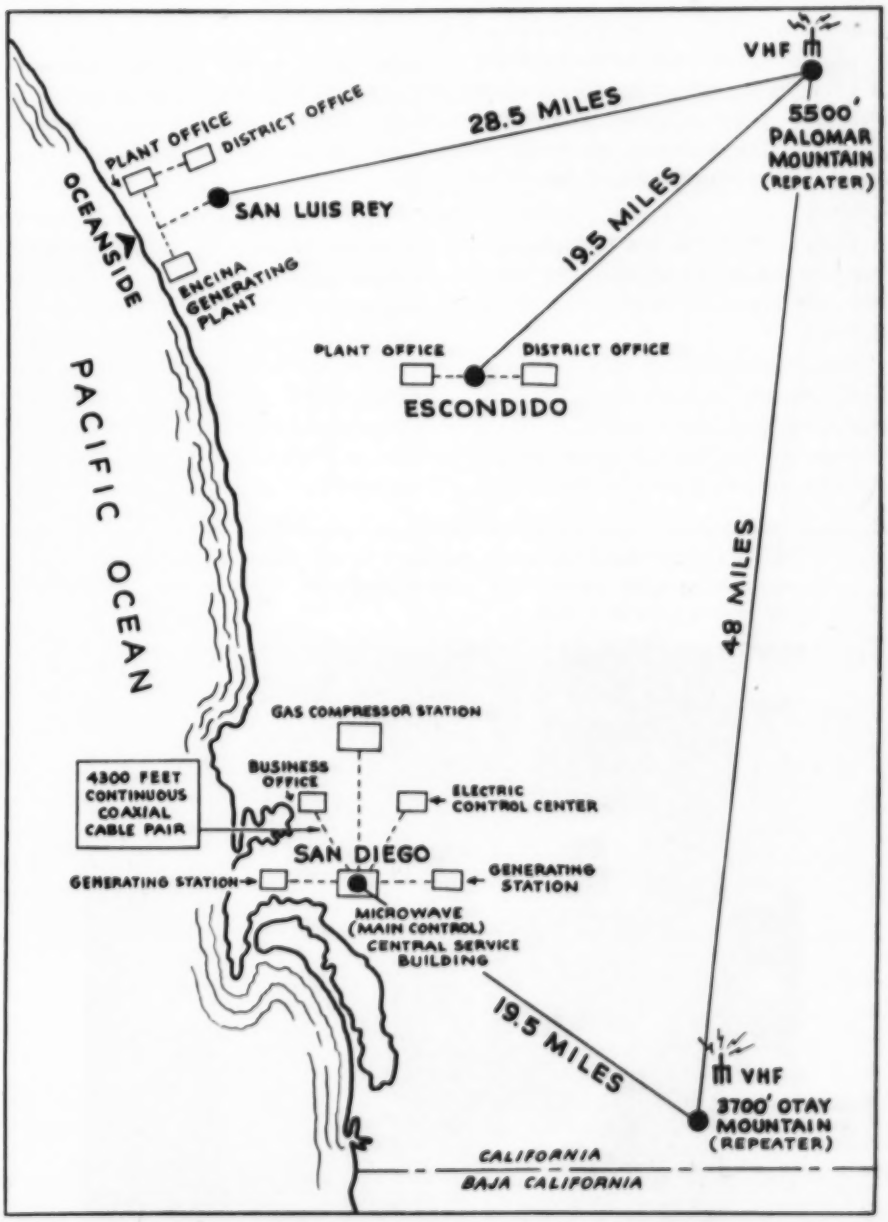
San Diego utility installs 2000-mc microwave system

MICROWAVE communication, a technique that has been used extensively and to considerable advantage for the past several years by the long gas transmission pipelines, is now finding new and interesting applications in the pipeline companies retail gas distribution outlet—the local gas utility company. One of the most recent additions to the growing list of gas distribution companies that have turned to microwave is the San Diego Gas & Electric Co. with the installation of a new 2000-Mc. Westinghouse system covering the company's lower southern California service area.

Backbone of the San Diego system is a single link between two repeater stations; one located on 3700-ft Otay mountain, almost on the Mexican border; and another located 48 miles north on 5500-ft Palomar mountain, home of the world's largest telescope. The Otay repeater feeds a terminal station in the city of San Diego while the Palomar repeater feeds terminals at San Luis Rey and Escondido. Additional terminals are contemplated as required.

The San Diego terminal is in the company's service building with tie lines to a main office building, electric dispatching center, gas compressor station, and two generating stations. The San Luis Rey terminal feeds the Oceanside plant and district offices as well as a third generating plant at Encina, while the Escondido terminal feeds plant and district offices in that town.

Present capacity of the system is 22 channels, with expansion to 30 channels available as required. The system's first 14 channels are a part of the company's three separate Automatic Elec-



Map of the microwave system showing connected services.

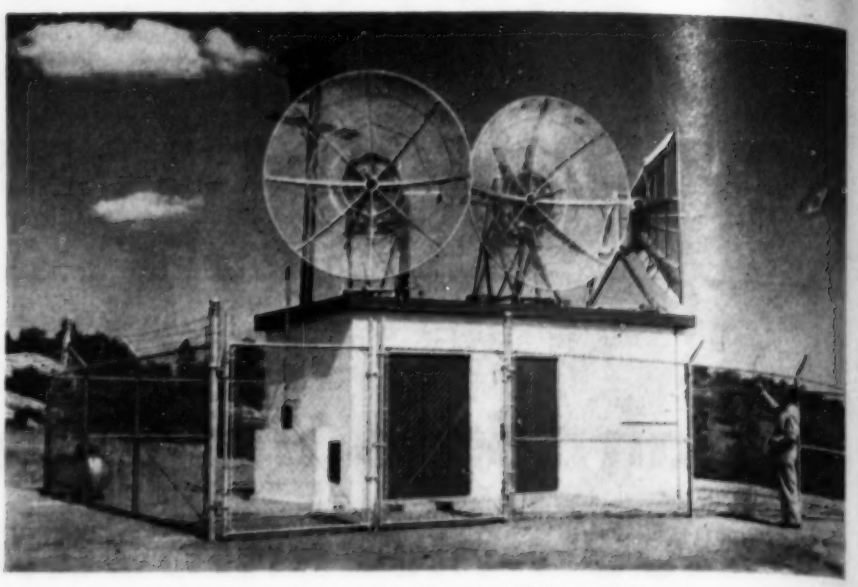
tric dial telephone systems. These three independent systems provide separate service to the company's business offices, operating departments and generating plants. Although each is a part of the microwave system they may not be tied together through its facilities.

Five of the talking circuits have multiplexing equipment located at the company's business office building. These channels are connected into the microwave transmitter at the service building through a 4300-ft pair of underground coaxial cables. Signal bandwidth of the coaxial cables is from 325 kc to 425 kc.

Two channels are devoted to telemeter: one electric and one gas. Six telemetering circuits are accommodated on the electric telemeter channel. The circuits are sub-multiplexed with audio tone. Each of the six telemeters has an output audio tone that varies from six to 27 cycles per second depending upon the value to be indicated. With 400-cycle separation between circuits the six are carried in a bandwidth of 300-2700 cycles.

The gas telemeter is a two-tone system that telemeters orifice meter static and differential pressures on a single channel.

Two channels are utilized to control VHF stations located at the two repeater stations. One channel is used as teletype channel for the entire system, and one channel is used by the electric department to tie into the Southern California Edison Co. carrier circuit at San Luis Rey. The remaining two channels will be used for supervisory control circuits.



Palomar mountain repeater station showing the three 10-ft parabolic antennas mounted atop the concrete transmitter housing. Propane tank at left contains fuel for auxiliary power generator.

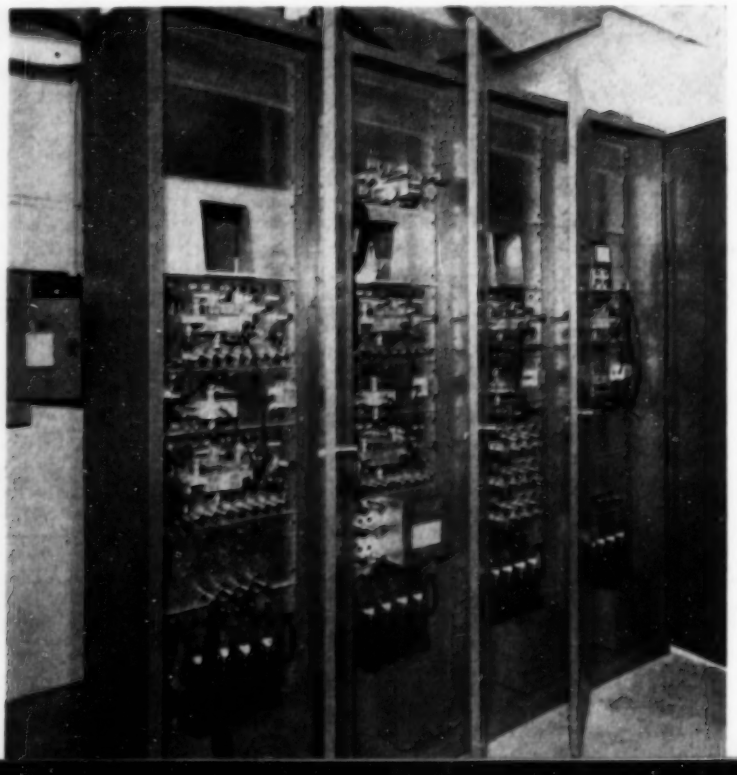
Otay mountain repeater station is powered entirely by sheppard diesel engine generators because no commercial power is available. The two diesels automatically alternate with each operating continuously a week at a time. Diesel fuel is contained in a 1000-gal. tank, which, because of the rugged terrain, is buried aboveground in a sand enclosure.

Palomar repeater operates from commercial power with an Onan auxiliary generator as standby power. Onan standby generators are also used at all three terminal stations. On Palomar and at San Luis Rey the auxiliary units use propane fuel while natural gas is used at San Diego and Escondido.

Because of the isolated location of both repeater stations, the service and alarm circuit is tied into an illegal entry alarm that operation when doors to any of the buildings are opened.

Palomar repeater has three 10-ft parabolic antennas mounted directly atop the concrete transmitter housing. Otay mountain station has one 10-ft parabola directed toward Palomar and one 6-ft parabola pointed toward San Diego. San Diego terminal has a 6-ft parabola while both San Luis Rey and Escondido have 10-ft parabolas.

The two diesel engine generators that serve as sole power source for Otay mountain repeater station. The units automatically alternate with each operating a week at a time.



Drilling contractors classified

The Central Committee on Radio Facilities of the API has concluded a series of conferences with the Federal Communications Commission resulting in a ruling by the chief of the Special Services bureau to the effect that drilling contractors applying for radio licenses are to be classified within the Petroleum Radio Service.

Previously it was the commission's practice to classify drilling contractors within the special industrial radio service on the theory that this classification was contemplated by the rule making which resulted in the establishment of the Petroleum Radio Service.

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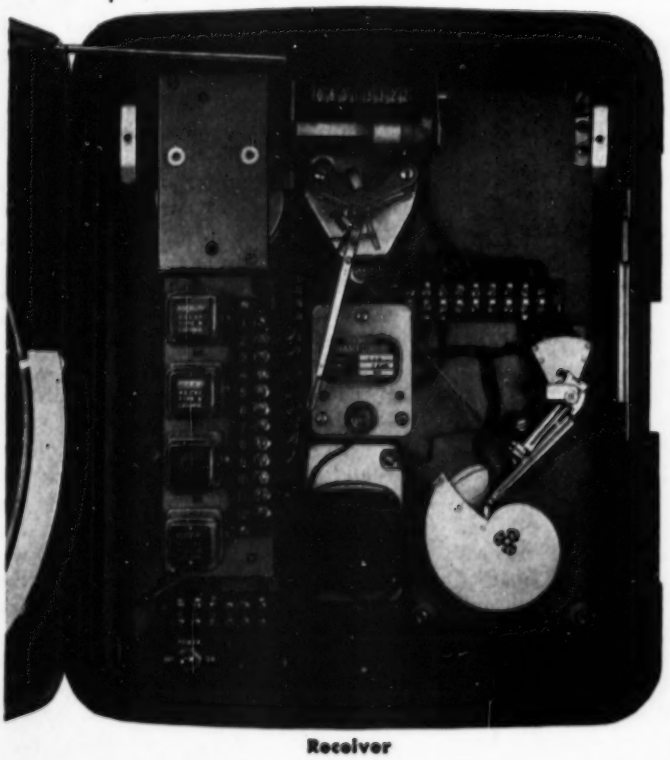
carrier current



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Teletax will transmit any measurement made with standard Foxboro measuring elements. Accuracy is ½% of full scale . . . regardless of normal variations in signal strength. Get full details on Teletax efficiency and economy. Write for Bulletin 17-11.

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LOW MAINTENANCE: A few drops of oil in the receiver motor every three months is all that's required; low 5 ma dc signal avoids failures.

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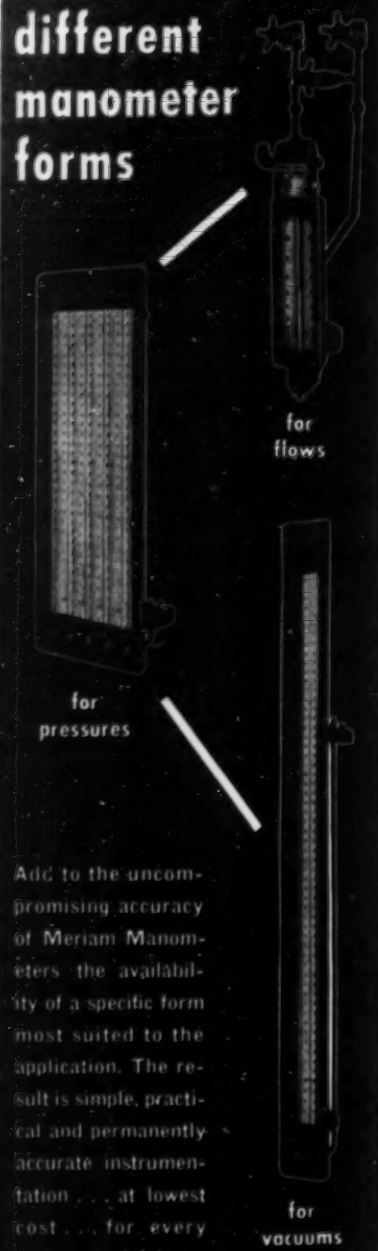

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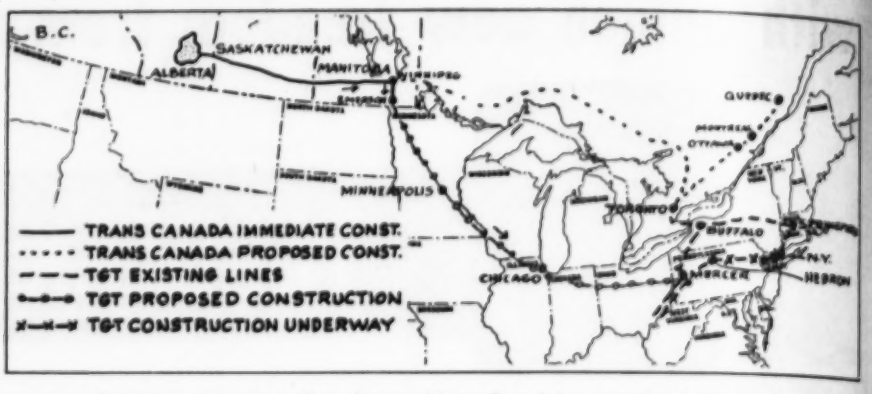
GAS pipeline news



Rumored route of new line that would tap Canada's vast natural gas supplies.

Frustration marks Canadian gas situation

The dilemma of having natural gas available without the means to transport it to market is still frustrating Canadian producers, pipeliners, official agencies, and potential consumers, though the latter are not the apparent cause of much concern. Various groups are again dickering in attempts to get the shut-in natural gas from the Alberta area, and other areas of western Canada, over to the potential domestic and industrial consumers in eastern Canada.

According to Canadian sources, negotiations to iron out the problem have entered a new phase. Reportedly, a proposal was submitted by Tennessee Gas Transmission Co., Houston, which has been favorably received by Bechtel Corp. Bechtel is consultant to Trans-Canada Pipe Lines Ltd., Calgary, Alberta, who still hopes to build its long-delayed line. The plans were the subject of a recent meeting among TGT's Gardner Symonds, Bechtel's Stephen Bechtel, N. A. Tanner and Charles Coates of Trans-Canada, and a Canadian government official. The results, if any, of these negotiations are not for publication. In answer to *GAS* attempts to secure reliable information, D. W. Brown, Trans-Canada's information officer, reported that "our company feels that, as inasmuch as we are only one party to the project, it would be impossible for us to make a report at the moment." Information obtainable from TGT is "no comment."

The news leaks currently making the rounds in Canada appear valid. It has been reported that TGT offered to purchase up to 500 MMcf/day from Trans-Canada at Emerson, Manitoba. This would preclude the construction of that part of Trans-Canada's proposed line from Alberta over to Winnipeg and south to Emerson. A contract would provide for gas on a firm take-or-pay basis for 25 years at a 95% load factor, and would absorb an existing contract between Northern Natural Gas Co., Omaha, and Trans-Canada that called for delivery to the former, at the same location, of 100 MMcf/day initially, increasing later to 200 MMcf/day. TGT would take the 500 MMcf/day and transmit the gas through a new pipeline it would build from Emerson to Mercer, Pa., via Minneapolis, south of the Great Lakes to Chicago, and to Mercer. Presumably, Trans-Canada's committed volumes to Northern Natural would be dropped off in Minneapolis by TGT.

TGT would then make natural gas available to Trans-Canada at the present Niagara river crossing area in any amount up to the maximum Tennesse would acquire from Trans-Canada at Emerson. Trans-Canada would use this gas to serve its eastern Canada markets. In this way, Trans-Canada's markets would be developed in the east before the segment of the all-Canadian line from Winnipeg to the Toronto-Montreal area was constructed. This section would be built during the second stage of construction, after TGT had supplied the eastern markets for about five years. The Winnipeg-to-Toronto pipeline, taking an all-Canadian route, would require an estimated $275 million to construct; it is obvious that senior financing would be facilitated if a firm and growing market could be realistically exhibited.

Gas from TGT's Emerson-Minneapolis-Chicago-Mercer line would be dropped off at Minneapolis and Chicago. The latter still has a rather im-

WHY NEW OIC DESIGN EXTENDS PLUG VALVE LIFE

TEST: This 150-lb. steel valve cycle tested with solvent; 3000 full openings and closings at 425 p.s.i.

RESULT: Pressure tight . . . still operable at low torque . . . no sign of galling or seizing.

Gland assembly: Resilient packing completely isolated from rotating parts. Requires little adjustment and assures longest possible packing life.

The gland liner is OIC "Alloy 40", an aluminum-silicon-bronze having a melting point in excess of 1750 F. It has low friction bearing characteristics, will not seize or gall and affords an additional pressure seal between the plug and itself.

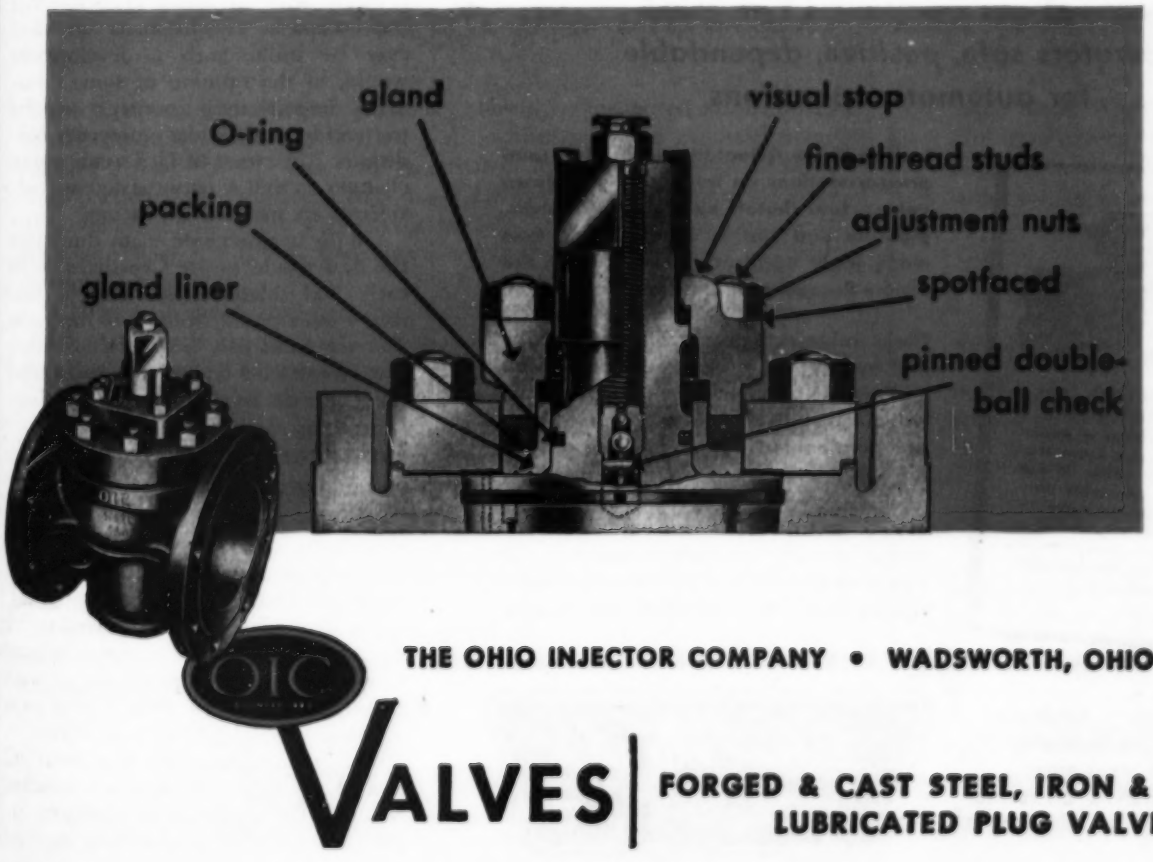
Precision gland adjustment: Fine-thread studs with semifinished, washer-faced nuts on spotfaced bearing surfaces afford accurate plug adjustment.

Position indicator on top of plug shank and *visual stop* on gland show position of plug at a glance.

Pinned double-ball check at bottom of plug shank eliminates blow-outs when lube screw or lube fitting is removed and precludes loss of balls into lubrication system under high-pressure gun lubrication.

Write today . . . request Form No. 1003, which will give you complete valve details, including specifications.

Order from your OIC Distributor



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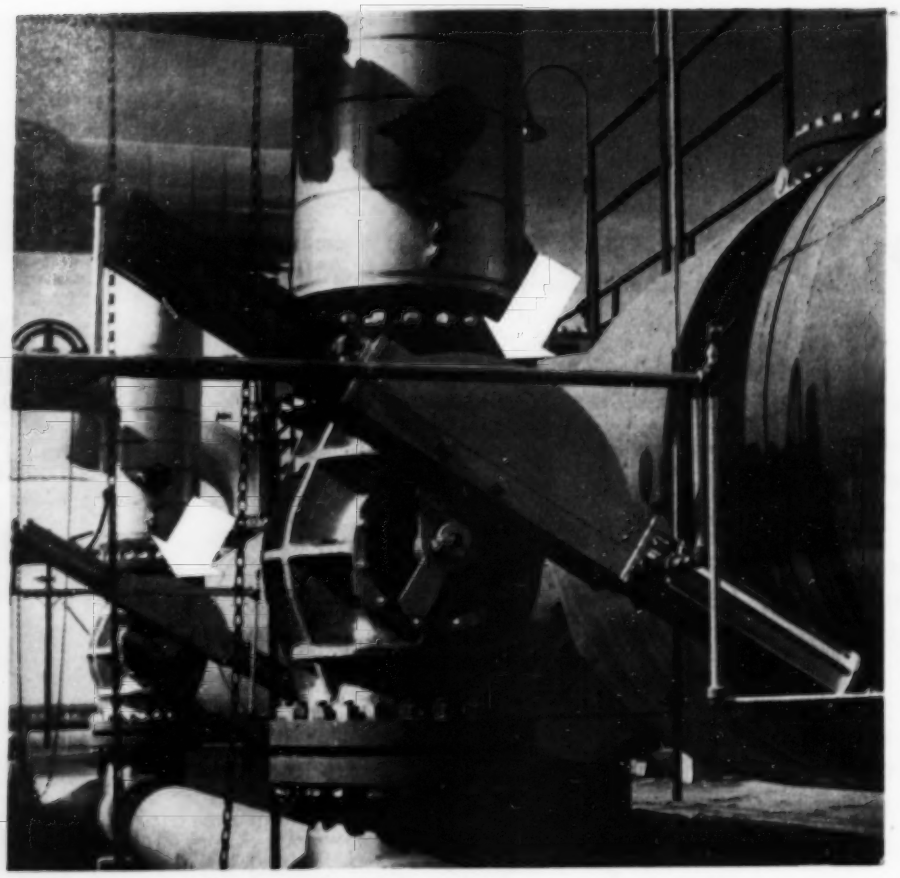
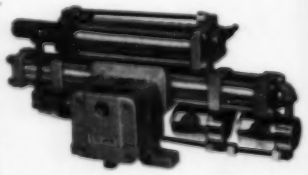
VALVES | FORGED & CAST STEEL, IRON & BRONZE, LUBRICATED PLUG VALVES



(Unretouched photo of Ledeen Valve Actuators in operation)

AMINE RECOVERY PLANT PLUG VALVES OPERATED BY LEDEEN VALVE ACTUATORS

Natural gas companies find these operators safe, positive, dependable for automatic operations



LEDEEN TIME DELAY VALVE

When lightning strikes or power fails, this new valve keeps station on line. If power is not restored within adjustable time delay limit set by the valve (2 seconds to 2 minutes), station is blown down and lines vented. Write for data on this compressor station watchdog.

Ledeen Valve Actuators are used in compressor stations on automatic blowdown valves, fuel shutoff valves, relief valves, pipeline and station block valves, and many more applications along with the Amine Recovery Plant installation shown.

These valve actuators are pneumatically and hydraulically operated, do not leak and are easily mounted by field personnel without modification of plug valve. They can be mounted in any position around the valve; and are available with auxiliary manual operation, either at valve or at a remote location. For preventive maintenance, actuator and control system can be operated without turning the valve. Torque ranges from 500 to 500,000 inch pounds.

WRITE FOR BULLETIN 3020.

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pressive list of customers waiting for domestic space heating service. Any of the Canadian gas then remaining would feed into TGT's existing system at Mercer. In the existing system, there is a nothern leg from Mercer that runs across New York state, to Springfield, Mass., and down to Greenwich, Conn. Another stub takes off from near Mercer and extends to storage fields at, and near, Hebron, Pa. TGT is currently building a line that will link the Hebron storage stub with the northern leg at Greenwich. On completion, they will have a 1000-mile loop on the delivery end of their system with integrated existing underground storage facilities that will be expanded by enlargement and the addition of new storage fields. Completion of the tie-in link will also mark TGT's entry into the gas-hungry Metropolitan New York market.

Under the over-all plan, the exchange of gas between Trans-Canada and TGT, at Emerson and Niagara, would operate until Trans-Canada's Winnipeg to Toronto line was completed. At that time, deliveries by TGT would cease and, in the event that Trans-Canada could deliver a surplus to Toronto, they would sell TGT said surplus for delivery at Niagara into TGT's New England-New York loop.

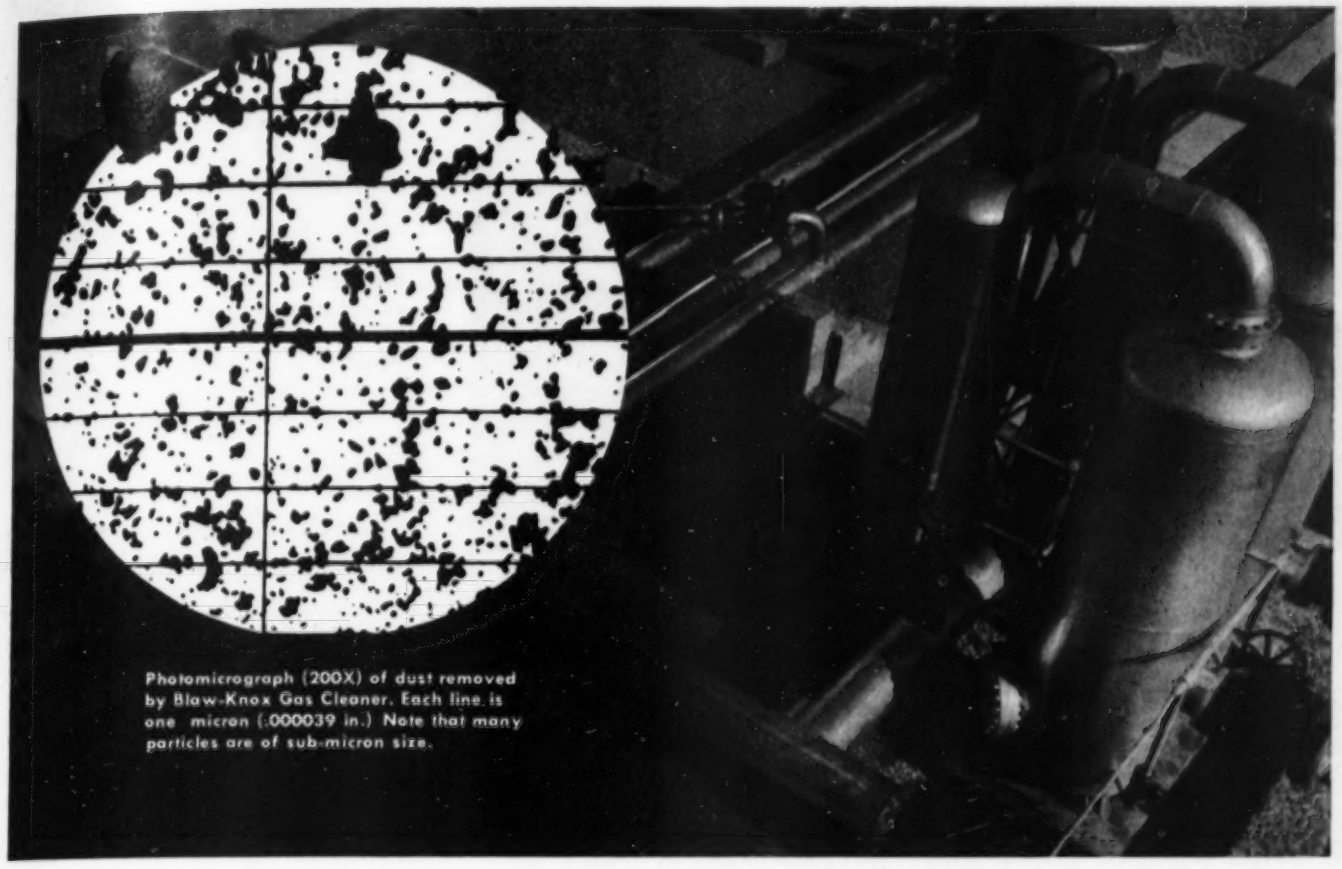
Some information sources say prospects for this project seem bright; others, however, point out that once the exchange is worked out and operating, it would be questionable to assume that the complete Trans-Canada line will ever be built. Such a development would, in the opinion of some Canadians, imperil their country's capacity to stand by itself under emergency conditions. Also, fears of U. S. trade policy changes, as well as national defense considerations, may become factors.

On the brighter side, many think that the deal would assure Canadians of an early and adequate gas supply that might sway public opinion to the point that the Canadian Government might consider this deviation from its original insistence on an all-Canadian pipeline.

Producer's abandonment of sales to Northern denied

An FPC presiding examiner has filed a decision, subject to review by the commission, denying an application by the J. M. Huber Corp., Berger, Texas, requesting permission to abandon its sale of natural gas to Northern Natural Gas Co., Omaha, except for the gas sold from one of the 12 wells involved (Dockets G-3038, 4957, and 4326).

Huber had contended that the FPC is without power to issue a certificate covering the deliveries to Northern inasmuch as Huber is unwilling to con-



Photomicrograph (200X) of dust removed by Blaw-Knox Gas Cleaner. Each line is one micron (.000039 in.) Note that many particles are of sub-micron size.

dust particles 20 microns and below travel easiest, farthest — do the most damage

Field tests prove Blaw-Knox Gas Cleaners remove even the smallest dust particles

The test of any gas cleaner's efficiency should be measured *not* in terms of the amount of dust collected, but in terms of the quantities entrained in the "clean" gas. The removal of a high percentage of large dust particles is a relatively easy task. However, it is the particle sizes of 20 microns and below that travel easiest, farthest and cause the most damage. Blaw-Knox Gas Cleaners remove even the smallest particles of these dusts.

A large number of field performance tests have been run to determine the dust removal capacity of Blaw-Knox Gas Cleaners. Inlet dust loadings ranged up to 547 pounds per million cubic feet of gas. Tests on the cleaner outlet showed absolutely no dust getting past.

The ability of Blaw-Knox Gas Cleaners to maintain such performance is due to an exclusive operating principle through which each tiny particle of dust is placed immediately in violent, intimate contact with oil. In the expansion separation stages, a major portion of dust-laden oil drops out of the gas stream. An oil-wet, multiple baffle, primary separator catches and agglomerates the remaining tiny wet particles. Finally the gas is scrubbed by an efficient, multiple vane mist extractor.

When you buy, be sure to specify Blaw-Knox, for when you place a Blaw-Knox Gas Cleaner on stream, you're sure to remove even the smallest particles of dust.

Blaw-Knox Electroil and Portable Hot Oil Foggers provide a safe, compact, efficient means of producing a stable oil fog in your gas streams.

A STABLE OIL FOG IN YOUR GAS MAINS:

Will wet down existing dust deposits.

Will prevent drying out and eventual dislodging of existing wet deposits.

Will moisten leather diaphragms.

Will curb internal corrosion of steel mains.

Will prevent loss of odorant by reaction with pipe scale.

Will help to prevent drying out of jute-joint packing.

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Through the rugged Smoky Mountains—

Blue Flag wraps entire 93.64-mile extension without a break

To protect the entire Topside Bristol Extension against corrosion, Tom Brown, Chief Engineer East Tennessee Natural Gas Company, specified Blue Flag glass fiber reinforcing pipe wrap.

Blue Flag wrapped the extension's entire 93.64 miles without a break, according to Mr. Brown. He writes:

"*During construction*, the pipeline was protective-coated against corrosion. Application was a standard 3/32" minimum-thickness coating, using Blue Flag Reinforcing Pipe Wrap for reinforcing the enamel.

"The total main line was machine field-wrapped. For over-the-ditch operation, Blue Flag Reinforcing Wrap proved very satisfactory. The wrap was easy to handle, light in weight but strong, with no breakage, and porous enough to release the gases. The total cost per foot was impressively low."

Blue Flag Pipe Wrap greatly increases enamel strength; offers exceptional resistance to cracking, thereby helping to prevent corrosion; adds years to a pipeline's service life. It is made of special highly inert glass and produced by L·O·F Glass Fibers' exclusive "Electronic-Extrusion" process. The uniform porosity of the fine glass fiber mat improves enamel distribution and greatly reduces the number of "holidays."

Available from strategically located warehouses of Blue Flag Distributors.

SEND FOR FREE FOLDER about L·O·F Glass Fibers' complete line of pipe wraps engineered for effective corrosion control. Write: L·O·F Glass Fibers Company, Dept. 74-85, 1810 Madison Avenue, Toledo 1, Ohio.

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A COMPLETE LINE FOR PIPELINE PROTECTION

BLUE FLAG Reinforcing Pipe Wrap, **DURAMAT** Protective Outer Wrap, **DURAMESH** Pipeline Fabric, **DURATAPE** Pipe and Joint Wrap

tinue to render the service. Presiding Examiner Purdue said that when, as in this case, the operations in question have persisted over a period of years, "when the application for a certificate authorizing the service is finally filed to avoid continued violation of the Act, and further when there is filed concurrently an application for abandonment of the same service, unwillingness, which is a self-seving position, cannot be given controlling or any effect." The presiding examiner ordered a certificate issued to Huber for the sales made from the 11 wells.

Texas Gas proposed to boost system by 108.6 MMcf daily

Texas Gas Transmission Corp., Owensboro, Ky., is seeking permission to construct about 198 miles of line and to add 20,270 hp along its system in Louisiana, Arkansas, Mississippi, Tennessee, Kentucky, and Indiana, to make an additional 35 MMcf a day available to Ohio Fuel Gas Co., and 73,589,000 cu ft daily to 36 other customers (Docket G-8828).

Texas Gas, which plans to spend $19,969,000 on the project, said that customer requirements are continually increasing and that by the 1956-57 winter season, peak day demands will have increased by 84,936,000 cu ft, with a further increase of 23,662,000 cu ft—to 108,598,000 over presently authorized service—expected by 1957-58.

Little Inch conversion to petroleum approved

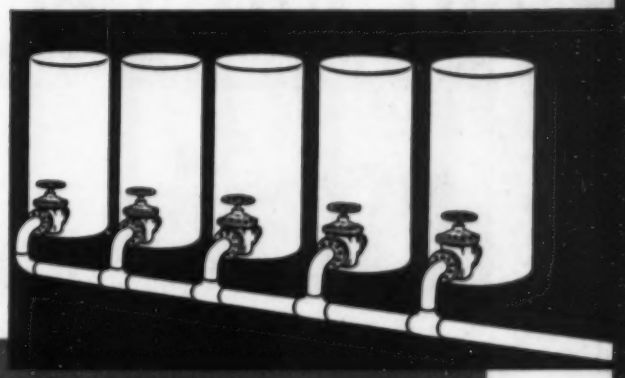
A big step was taken by Texas Eastern Transmission Corp., Shreveport, toward becoming the first natural gas pipeline company to undertake the transportation of petroleum products on a large scale. The step was heralded by the June 24 unanimous decision of the FPC for the order and certificate necessary to permit Texas Eastern to abandon 1163 miles of its Little Big Inch pipeline from natural gas service and to construct replacement natural gas pipeline capacity. Under announced plans, Texas Eastern will reconvert 1163 miles of Little Big Inch from Beaumont, Texas, to a terminal on the Ohio river near Moundsville, W. Va., as a common carrier of "refined oil products (including LPG products) by or before the fall of 1956," according to George T. Naff, president of Texas Eastern.

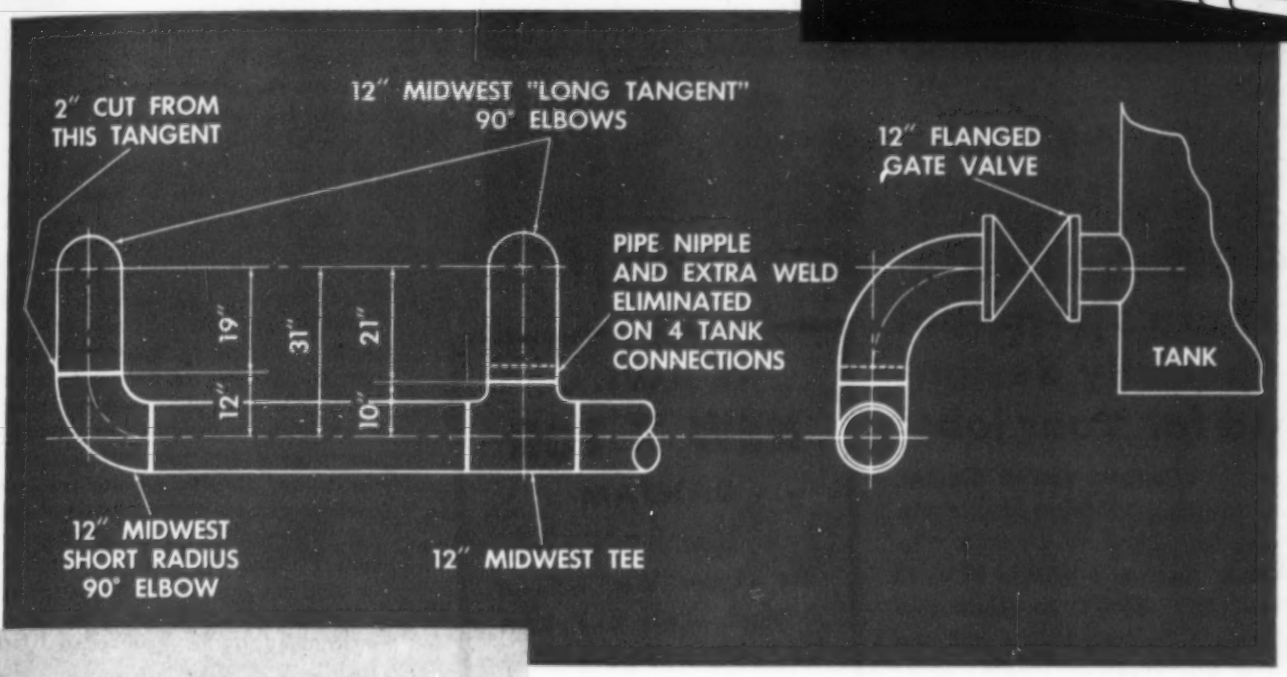
The 20-in. diameter Little Big Inch, and its companion line, the 24-in. Big Inch, were built during World War II

MIDWEST "LONG TANGENT" ELBOWS

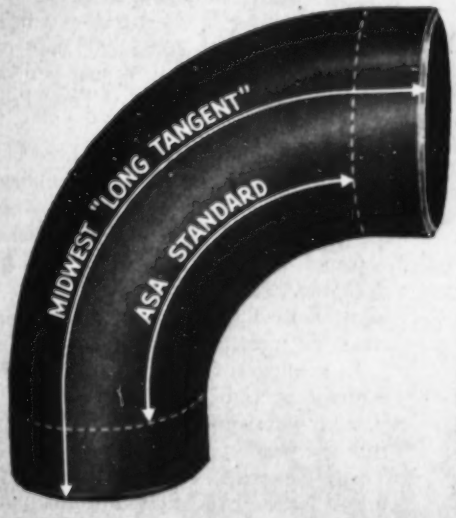
SAVED $156.20

On This Welding Piping





MIDWEST "LONG TANGENT" ELBOWS COST NO MORE THAN OTHER ELBOWS



The Problem:

To connect the five tanks shown in the sketch at top to a common 12" header.

The Difficulty:

The center-to-outlet dimension of the 4—12" tees is only 10", while the shortest elbow available measures 12" center-to-end, Thus, if standard long radius elbows are used next to the five tank valves, four short nipples and four extra 12" welds would be required.

The Solution:

By using Midwest "Long Tangent" elbows as shown in the blueprint, the expense of the four extra nipples and welds was eliminated at the cost of just one cut! The actual net savings made by "Long Tangent" elbows on this job was $156.20.

Remember—Midwest "Long Tangent" elbows cost no more than regular elbows! For further information, write for Catalog 54.

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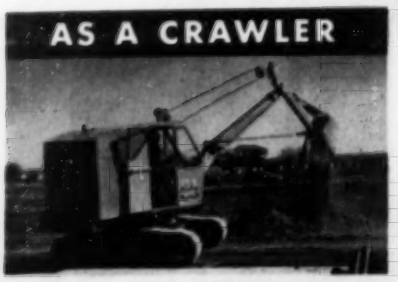

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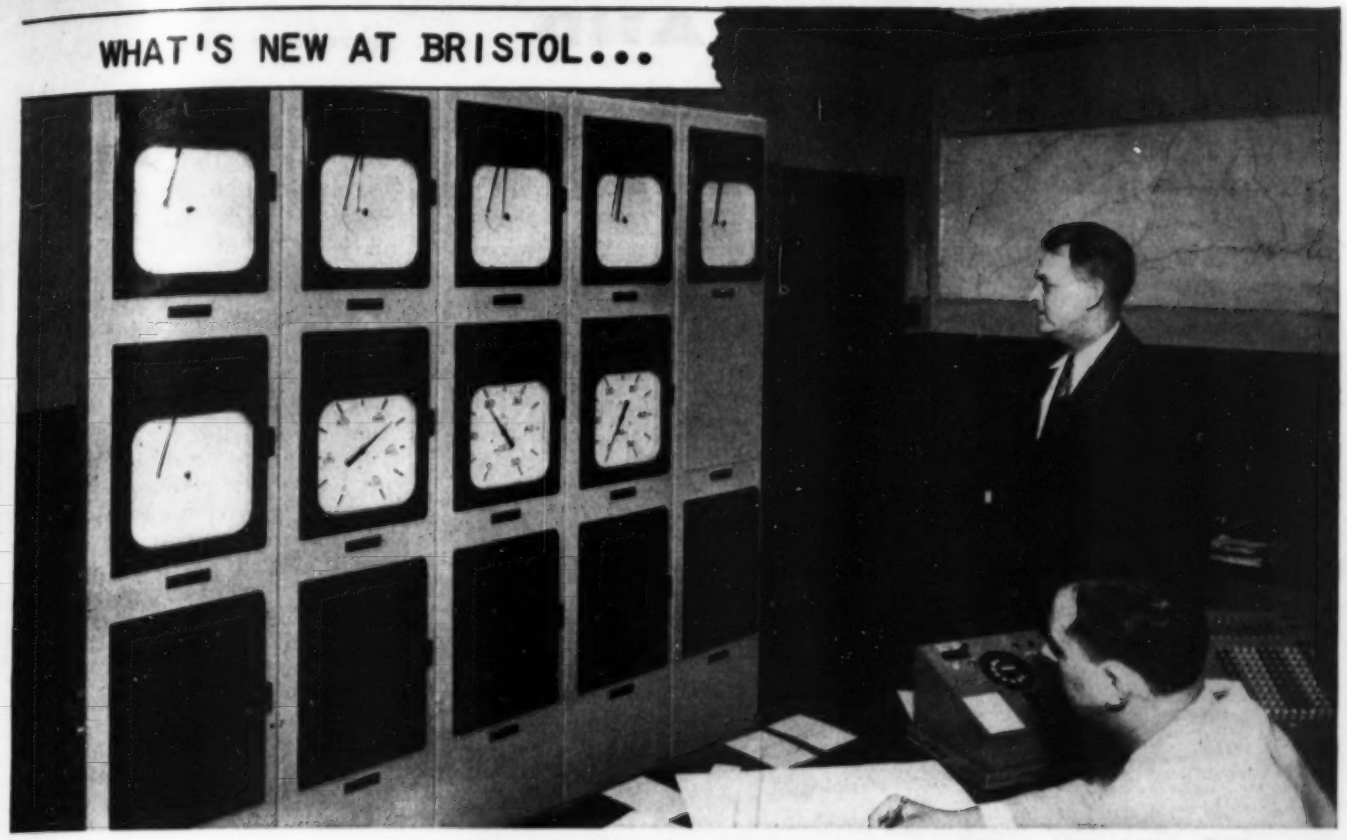
to alleviate the critical demand for crude oil and products on the Eastern Seaboard that was seriously imperiled by enemy destruction of some available tanker tonnage. The lines were operated during the war by War Emergency Pipelines Inc. and were a major factor in breaking the transportation bottleneck.

In 1953, the management hinted that it was seriously considering reconverting the Little Inch to petroleum products service. Early in 1954, Texas Eastern Production Corp., a subsidiary of Texas Eastern Transmission Corp., purchased all of the issued and outstanding common stock of Triangle Pipeline Co. (a common carrier of petroleum products) for $3,195,404. Triangle's products lines served east Texas, north Louisiana, and south Arkansas gasoline plants and refineries. Their products are transported to various points along its pipeline system, which extends to a water terminal on the Mississippi river. Texas Eastern Transmission advanced funds to its production company to purchase Triangle's stock and retained an option, effective for the calender years of 1955-56, for purchase of the Triangle stock from the production company, at the original cost plus any increase in the earned surplus account per books of Triangle during the period from Dec. 31, 1953 to date of exercising the option. Presumably, Triangle's system will be used as a gathering system to provide additional petroleum products for movement in the reconverted Little Inch.

Texas Production has considerable crude production in addition to the sizable volumes of natural gas supplied the parent company. In 1953, crude oil and condensate production stood at 312,243 bbls, and during 1954 this was increased to 415,354 bbls. Triangle pipelines handled 20,832,905 bbls of products during 1954, its first year of operation as a subsidiary of Texas Production.

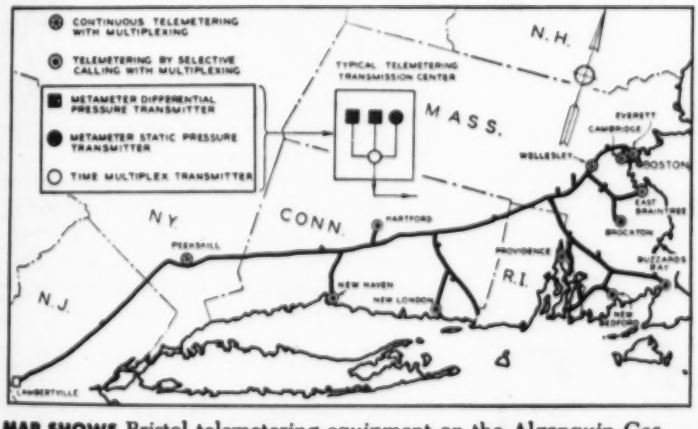
The capacity of the reconverted Little Inch line will approximate 85 million bbls per year. This immediately raises the question of where these appreciable volumes of refined products will be available? There has been no mention in the Texas Eastern releases of intended crude oil transmission.

In a telegram to *GAS*, Jack Clarke, director of public relations for Texas Eastern Transmission Corp., stressed that the present natural gas capacity of Texas Eastern's system will be maintained by the construction of 382 miles of 30-in. line that will cost $71.8 million and will be adequate to deliver 200 MMcf/day to an existing 30-in. line that extends from Kosciusko, Miss.



EASY-TO-READ Bristol Metameter Telemeters at Algonquin Gas continuously record information on twelve measurements of static and differential pressures in the Boston area. Bristol Multiplex receivers (bottom row) segregate incoming signals and direct them to proper receivers.

Continuous, system-wide telemetering pays off for Algonquin Gas



MAP SHOWS Bristol telemetering equipment on the Algonquin Gas Company's pipeline.

Every gas company sells two commodities. Gas – and service. *Reliable* service. Service that builds confidence. Service that turns prospects into customers, customers into friends.

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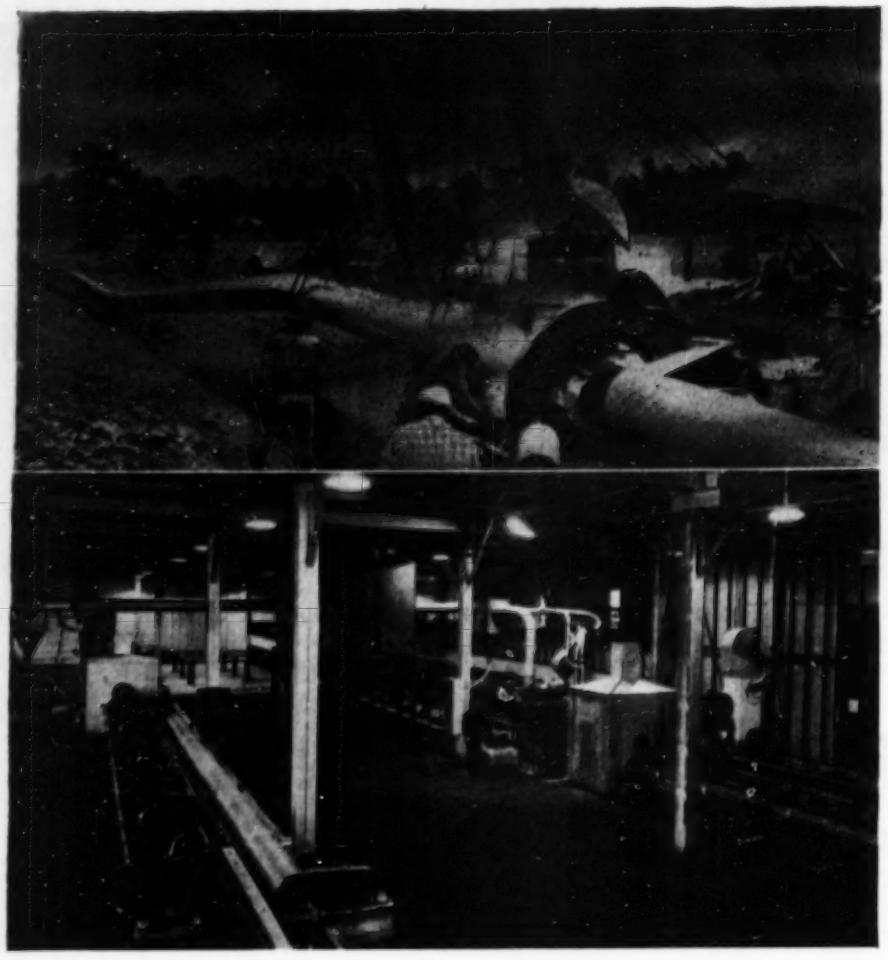

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pipeline news • *Cont'd.*

(where gas is presently purchased from the United Gas Pipeline Corp.) to the Connellsville-Oakford storage field areas of Pennsylvania. This construction will place the new 30-in. line between Beaumont and Kosciusko; thereby connecting the Wilcox Trend Gathering System's pipelines (which terminate at Provident City, Texas) and 16- and 20-in. pipelines currently operated by Texas Eastern between Provident City and Beaumont, with the 30-in. line carrying natural gas to the Eastern Seaboard.

Texas Eastern has apparently experienced relatively uneconomical factors in operating the Little Inch as a basically parallel line with the larger diameter Big Inch. Lines with larger diameter are much more economical to operate than the Little Inch with its 20-in. diameter. Preliminary calculations reveal that the capacity of a 20-in. line can be easily doubled by the installation of 30-in. pipe, and the line with the 30-in. diameter increases construction cost by only an approximate 30-40%. Thus, if the current capacity of the 20-in. Little Inch line is around 200 MMcf/day, the shorter 30-in. line can easily substitute as a carrier for this volume and, in actuality, could be adequate for much larger volumes with the installation of additional compressor station horsepower.

The reasons given Texas Eastern's stockholders for the reconversion of the Little Inch are:

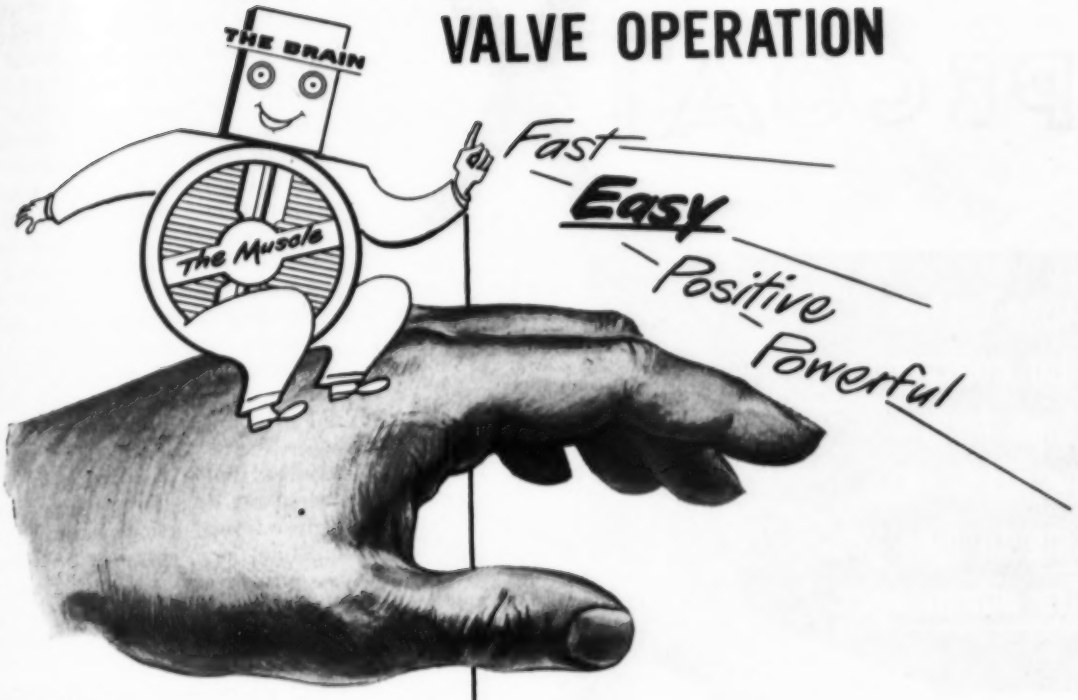
1. The transfer of gas being carried by the Little Inch to the 30-lin. line will permit a more economical operation which will allow the new construction to be accomplished without an increase in gas rates to consumers.

2. The new system will extend into southern Louisiana and Mississippi, which will facilitate purchase of large proven reserves of natural gas.

3. The project will give greater flexibility to natural gas operations by linking in the southern terminus of the 30-in. Koscuisko-Connellsville line with the south Texas supply area and the remainder of the system.

The announcement stated that $14.8 million will be allocated to reconvert the Little Inch to its originally designed purpose—the transportation of petroleum products—and to construct new tank farms (for in-transit products storage) and laterals needed to reach new market areas. Texas Eastern acquired a 20-tank liquid storage farm at Beaumont, Texas in the original purchase agreement. This tank farm has a capacity of 1.1 million bbls and is now leased to another company, but it can be returned to Texas Eastern if desired after

ONE MAN MANUAL VALVE OPERATION



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the conversion of the 20-in. line to petroleum products service.

The over-all project will involve an expenditure of $86 million, $14.8 million for the reconversion job and $71.8 million for the replacement pipeline. FPC declared that Texas Eastern's ability to finance the project is realistic, and Mr. Naff stated that the basis for senior financing has already been arranged by an agreement with eight insurance companies providing for the purchase by them of $40 million principal amount first mortgage 3¾% pipeline bonds.

Mr. Naff, Texas Eastern's dynamic president, further stated that "The reconversion project . . . will be set in motion at once, and we expect that the line will initiate operation . . . by or before the fall of 1956." The petroleum products pipeline operation will be conducted as a division of the parent company, but such operation, unlike the gas pipeline operation, will be subject to the jurisdiction of the Interstate Commerce Commission pursuant to the provisions of the Interstate Commerce Act.

FPC dismisses applications of 20 independent producers

Applications by 20 independent producers requesting certificates for natural gas sales have been dismissed, for want of jurisdiction, in a decision filed by an FPC presiding examiner (Docket G-2401 et al).

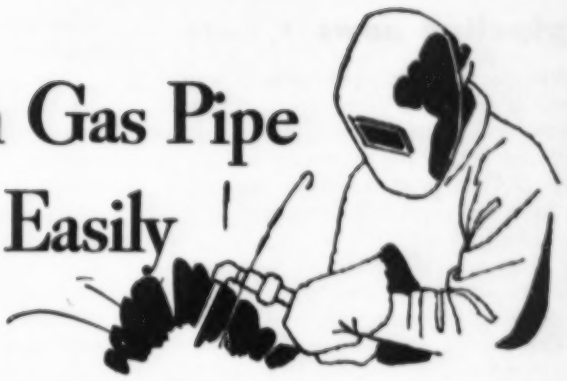
At the same time certificates were granted to two other companies authorizing them to construct natural gas pipeline facilities and to deliver natural gas in connection with sales to Transcontinental Gas Pipe Line Corp., Houston.

One of the certificates authorizes Dixie Pipe Line Co., Dallas, to construct 20 miles of pipeline in Jefferson Davis County, Miss., extending from the Gwinville field to a connection with Transcontinental's system. Estimated cost is $425,000. Dixie would sell a minimum of 14.4 MMcf and a maximum of 25 MMcf daily to Transcontinental.

The other certificate was issued to The Gwin Co., Dallas, authorizing it to sell gas purchased in the Gwinville field to Dixie for resale to Transcontinental.

Nineteen of the 20 producer applications that were dismissed involve proposed sales of gas produced by them in the Gwinville field for resale to Dixie. The remaining application is by Humble Oil and Refining Co., Houston, seeking a certificate authorizing sales of natural gas produced by it in the Gwinville field to Southern Natural Gas Co., Birmingham, Ala. A portion of the nat-

Bethlehem High-Strength Gas Pipe Resists Fatigue—Welds Easily



Bethlehem High-Strength Gas Pipe is recommended for pipe-line compressor stations and other locations where severe vibrations or extremely high pressures are encountered.

This pipe is fabricated from as-rolled plates of Mayari R, Bethlehem's high-strength low-alloy steel. Mayari R has a yield point of 50,000 psi min, an endurance limit of approximately 50,000 psi, high corrosion resistance and excellent workability and weldability.

RESISTANCE TO FATIGUE—Mayari R steel's endurance limit is unusually high—about 50,000 psi (60 to 75 pct of its tensile strength of 70,000 psi minimum). In addition, Mayari R steel is extremely ductile, with 22 pct minimum elongation in 2 in. Pipe fabricated from Mayari R plate has the exceptional endurance strength, extreme ductility and high impact qualities needed for handling vibration, pulsation and variable shock-loadings.

LIGHTER WALLS—When you use Bethlehem High-Strength Gas Pipe you can specify much lighter walls than with ordinary carbon-steel pipe. This results in savings in material, as well as in the cost of transportation, handling and field welding.

WELDS READILY—Bethlehem High-Strength Gas Pipe is readily welded by following normal field-welding procedures, using mild steel electrodes.

FOR NORMAL PIPELINE SERVICE we recommend Bethlehem Gas Pipe fabricated from carbon steel, meeting specifications ASTM A134 or API 5LX42. Comparative weights and test pressures for these grades of pipe, as well as for pipe made from Mayari R, are shown in the table below.

All grades of Bethlehem Gas Pipe are made in 40-ft lengths, with beveled or square ends, and in all diameters from 18 in. OD. We can grit-blast, prime, coal-tar enamel and wrap the pipe to your specifications.

A phone call or letter to the nearest Bethlehem sales office will bring you full information about Bethlehem Gas Pipe, in Mayari R or carbon-steel grades.

Comparative Maximum Test Pressure: MAYARI R, API 5LX42 and ASTM A134 Steel Pipe

Pipe OD In.	¼ IN. THICK				⅜ IN. THICK				½ IN. THICK				¾ IN. THICK				1 IN. THICK			
	Wt lb per ft	Test Pressure psi Mayari R	API 5Lx42	ASTM A134*	Wt lb per ft	Test Pressure psi Mayari R	API 5Lx42	ASTM A134*	Wt lb per ft	Test Pressure psi Mayari R	API 5Lx42	ASTM A134*	Wt lb per ft	Test Pressure psi Mayari R	API 5Lx42	ASTM A134*	Wt lb per ft	Test Pressure psi Mayari R	API 5Lx42	ASTM A134*
18	49	1180	990	665	73	1770	1490	960	96	2360	1985	1275								
20	54	1120	920	575	81	1590	1340	860	107	2130	1785	1150								
22	63	965	820	520	93	1450	1220	815	118	1935	1630	1040								
24	67	885	750	475	99	1330	1120	745	130	1770	1490	955								
26	73	820	690	440	107	1225	1030	690	141	1635	1380	880	202	2450	2050	1325				
28	79	760	640	405	117	1140	955	640	153	1515	1275	820	219	2270	1910	1225				
30	85	710	595	380	125	1060	895	600	164	1415	1190	765	235	2130	1785	1145				
32	92	665	560	355	134	1000	835	560	176	1325	1115	715	252	1990	1675	1075	330	2650	2230	1430
34	97	625	525	335	143	940	785	505	187	1250	1050	675	268	1875	1575	1010	352	2500	2100	1350
36	105	590	495	315	152	885	750	480	200	1180	980	635	285	1770	1490	950	374	2360	1980	1275
42	118	505	425	270	173	760	640	410	228	1010	850	545	334	1525	1275	815	440	2020	1700	1090
48	135	440	375	235	199	665	560	360	263	885	745	475	384	1325	1115	715	506	1770	1485	955
60	170	355	300	190	252	530	450	285	331	710	595	380	483	1060	890	570	638	1415	1190	765
72	210	295	250	160	306	440	375	240	403	590	497	320	582	885	740	475	770	1180	990	635
84	238	250	215	135	353	380	320	205	464	505	425	270	672	755	635	410	902	1010	850	545

*ASTM A283 Grade B, to be used when ordering to ASTM A134 Specification. If ASTM A283 Grade C is used instead, the test pressures may be increased by 11 pct. Pipe can be furnished in diameters intermediate to those shown above.

Test pressures above are based on stressing steel to 85 pct of minimum yield point:
Mayari R—85 pct of yield point = 42500 psi
API 5LX42—85 pct of yield point = 35700 psi
ASTM A134—85 pct of yield point = 22950 psi
Formula used: $P = \frac{2ts}{D}$

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BETHLEHEM STEEL

ural gas which Humble sells to Southern is produced from the same units involved in the applications of some of the producers proposing to sell to Gwin. The producers also filed application for permission to abandon this service to Southern.

The undivided parts of working interests owned by the 19 independent producers proposing sales to Gwin have been pooled into various field production units operated by Humble, The Superior Oil Co., and Hunt Oil Co. The production of the units is sold by the latter three companies as operators to Southern.

The presiding examiner concluded that the right "to take in kind" (wherein a producer has the right to take, instead of compensation therefor, the gas which lies in or under his land, or its equivalent in other gas) "is a valid existing right vested in applicants pursuant to the decisions of the supreme court of Mississippi and the conservation laws of that state; that taking in kind as here proposed is not subject to the provisions of Section 7(b) of the [Natural Gas] Act or to the jurisdiction of the Commission; and that the joint application for permission to abandon service . . . should be dismissed for want of jurisdiction. . . ."

In dismissing Humble's certificate application, the presiding examiner—after a lengthy review of the legislative history of the Natural Gas Act—declared that the "conclusion is inescapable that Congress did not intend to regulate the wellhead, lease or field unit sale of natural gas, the legislative history of the Act and the amendment of Section 7(c) therof convincingly demonstrating that at least the certificate provisions of the Act do not apply to such sales." Presiding Examiner Simpson similarly dismissed the 19 other certificate applications, holding that they and the Humble application stand on substantially identical facts.

Clause to stop gas sale at 10 cents/Mcf refused

An FPC presiding examiner, while issuing certificates to Cities Service Gas Co. to build new facilities and to Signal Oil & Gas Co. for sale of gas to the company (Dockets G-2569 and 2570), has refused to include a condition that would have the effect of prohibiting any sale by Signal to Cities Service for a price in excess of 10 cents/Mcf, as had been urged by two intervenors as well as by the commission staff.

The decision authorizes Cities Service to build a 15½-mile, 16- in. pipeline to transport gas purchased from Signal at the latter's gas processing plant in Carter county, Okla.

Lone Star and Oklahoma Natural, the intervenors, contended that the proposed 12-cent-per-Mcf price, which is 2 cents above the current maximum 10-cent rate now being charged for gas produced in this area, would "trigger" price increases under favored-nation clauses in gas purchases contracts.

Commenting on a study by the commission's staff that showed that Signal would earn between 8 and 16% on the investment with the 10-cent price, Presiding Examiner Costello asked if this would provide a proper basis for a conclusion that the 12-cent rate is not "just and reasonable." If so, he stated, it would not seem difficult to argue that even the 10-cent rate may be excessive, and that if there is to be any rate condition whatever, it should not be premised upon the proposition that the presently prevailing area sales price, whatever it happens to be, is, without further proof, "just and reasonable."

In discussing the intervenors' argument that the proposed 12-cent rate would trigger higher rates throughout the area, Presiding Examiner Costello pointed out that none of the producers who sell to Lone Star would be able to avail itself of a "favored nation" con-

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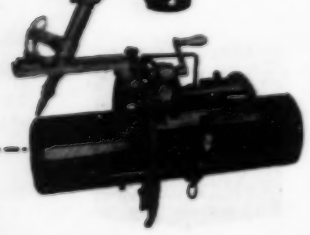

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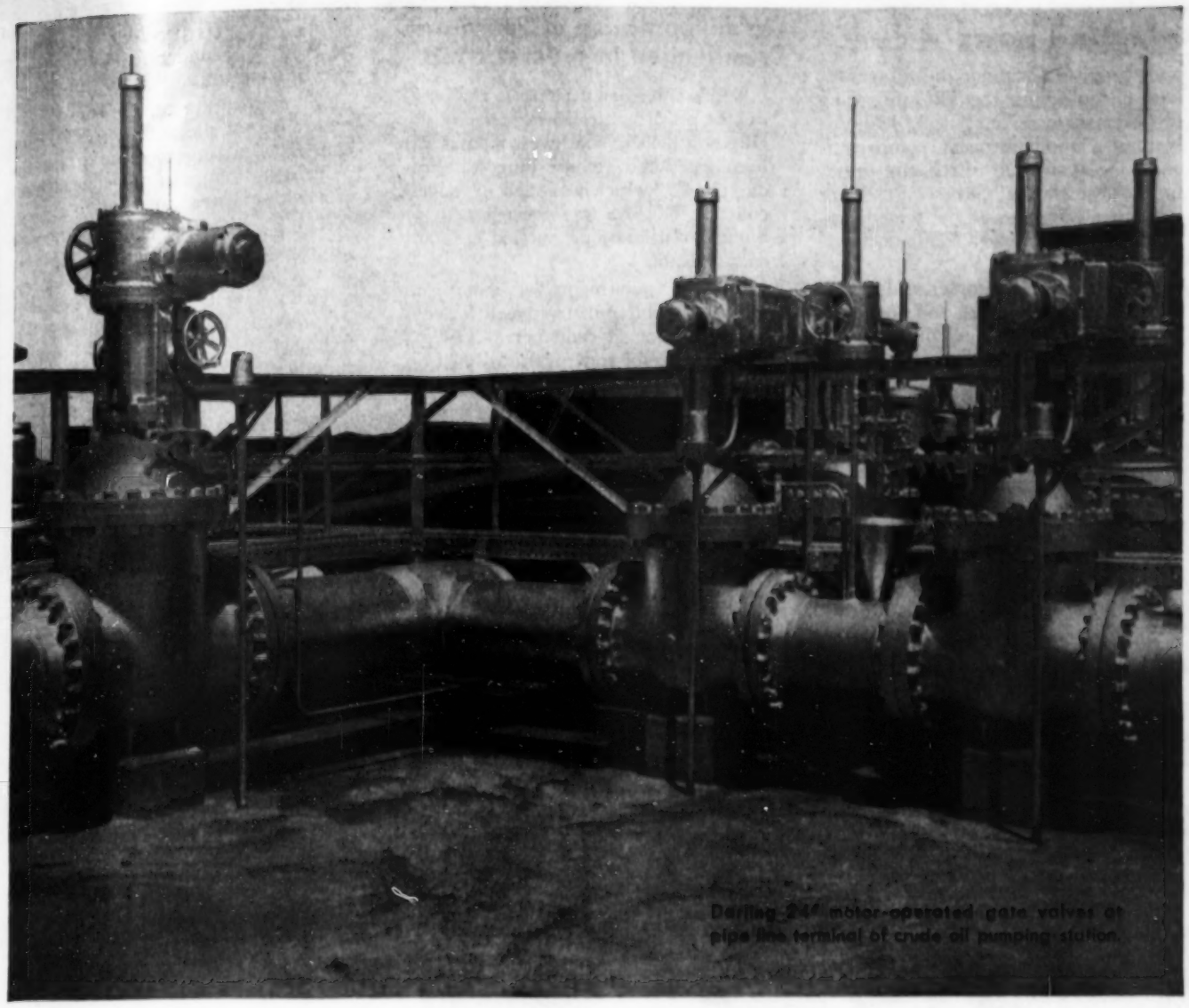

Darling 24" motor-operated gate valves at pipe line terminal of crude oil pumping station.

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HERE'S the simple answer. There's little that *can* go wrong with Darling *fully revolving double disc, parallel seat gate valves.* This unique principle recognizes and thus *avoids* the common sources of valve failure . . .

Take seat misalignment for example. The Darling principle automatically compensates for this common cause of leaks! Then too, there's *uniform* distribution of disc-and-seat wear, positive relief of wedging pressure as discs unseat, and *easier operation* even under pressure and temperature extremes.

Finally, with these Darling gate valves that work better, longer, you naturally minimize down time and maintenance expense. Why not get all the facts on Darling gate valves of the proper size and type for your own service needs? We'll be happy to cooperate.

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Williamsport 26, Pa.

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tract provision without the filing of a rate schedule with the FPC providing for such an increase. Since Oklahoma Natural, a wholly intrastate company, is unable to avail itself of the rate provisions of the Natural Gas Act, Presiding Examiner Costello said, its remedy appears to lie with the Oklahoma legislature.

The Presiding Examiner said that if the 12-cent rate is unjust and unreasonable, that rate may be examined by the FPC in a regular rate proceeding.

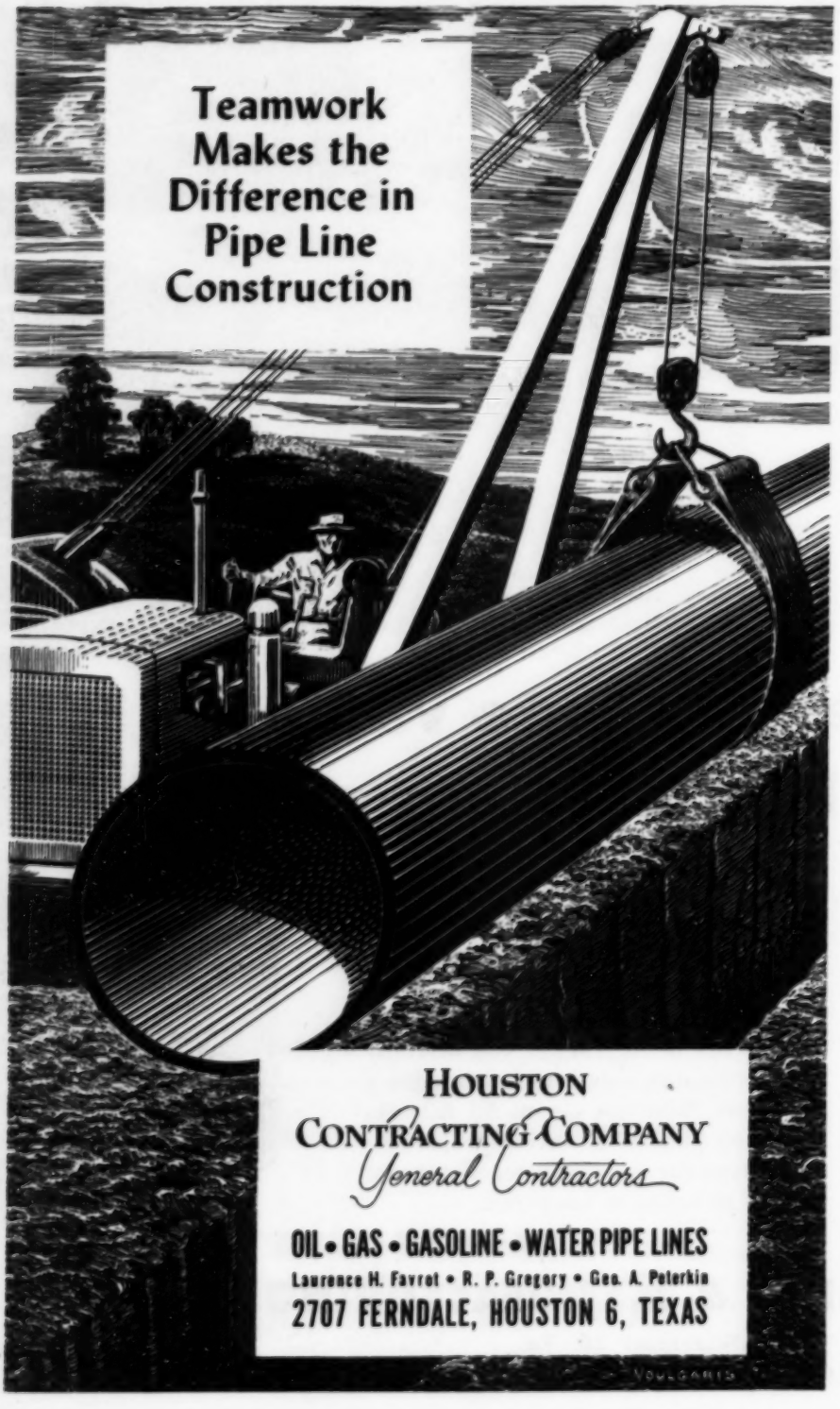
Wellhead price at Hugoton challenged in federal court

What is termed a test case challenging the prevailing wellhead price in the Hugoton field of southwest Kansas has been instituted against Hugoton Production Co., which was sued in federal court in Wichita to force payment of higher royalties on production in Grant county, Kan.

Sullivan Investments Inc. is suing to recover the difference between the royalties based on 11 cents per Mcf of gas it now receives and royalties based on 18 to 20.6 cents per Mcf it claims to be entitled to under lease agreements affecting six wells.

In commenting on the suit, the attorney for the plaintiffs said, "Pipeline companies in Hugoton tend to treat the 11-cent state minimum wellhead price as a ceiling instead of a floor."

The petitioner claims he became eligible for the higher royalties last Nov. 1 when Hugoton Production entered into a higher escalated rate with its pipeline connection, Kansas Power & Light Co. The petition asks that the judgment be made retroactive by the November 1954 date.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Additional contracts let by Pacific Northwest

Additional construction contracts totaling $7,065,000 and covering 509 miles of mainline and laterals and 47 miles of gathering lines of the Pacific Northwest Pipe line Corp.'s line have been awarded. (See *GAS*, July, page 129.)

The contracts awarded cover the four mainline sections running from near Burley, Idaho, to the Columbia river at the Oregon-Washington border. Also, some 97 miles of lateral lines running to the Big Piney and Piceance creek field as well as 47 miles of gathering lines. Contracts on the work are as follows:

H. B. Zachry Co., San Antonio: 214 miles of 22-in. between Burley and Payette, Idaho.

Fulghum Construction Co., Harrisburg, Pa.: 198 miles of 22-in. between Payette and the Columbia river.

A. J. Curtis Construction Co., Casper, Wyo.: 54-mile, 16-in. lateral and 31-mile gathering line (2⅜ in. to 18 in.) from near Kemmerer, Wyo. to the Big Piney field.

R. H. Fulton & Co., Lubbock: 43-mile, 10¾-in. from Rangely, Colo. to Piceance cheek.

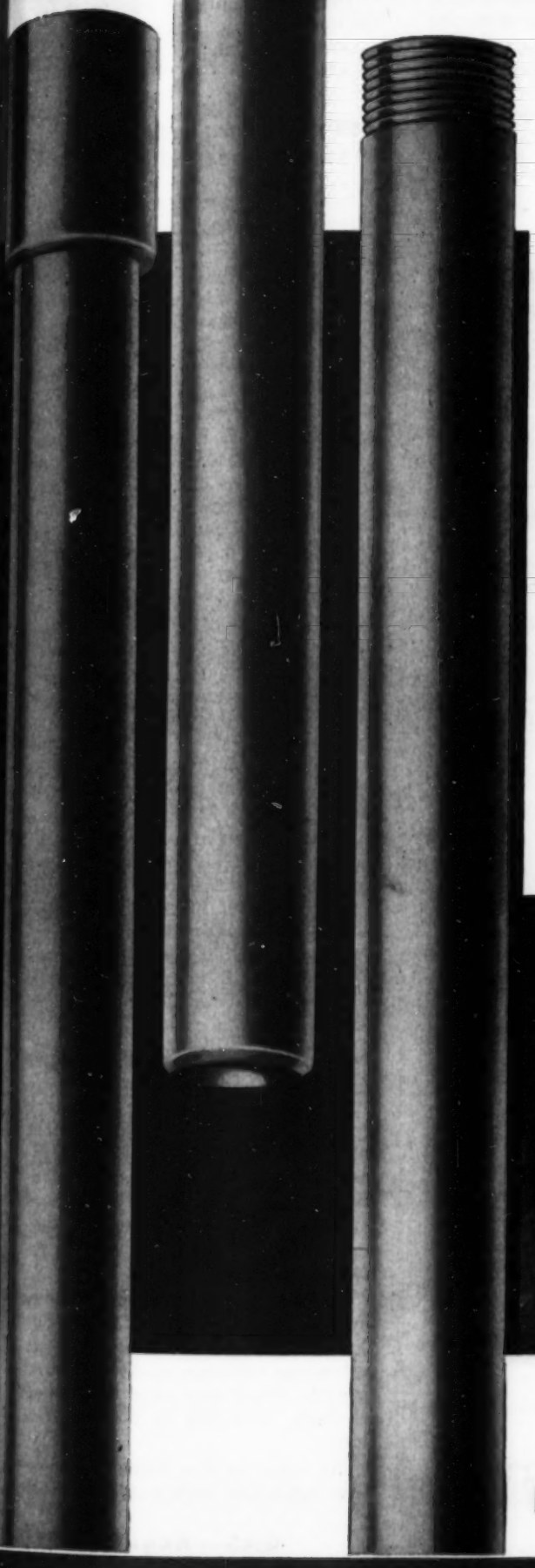
New plans laid to block American Louisiana project

While the FPC was approving American Louisiana Pipe Line Co.'s plan for financing its proposed pipeline project, Panhandle Eastern Pipe Line Co. planned some new legal maneuvers aimed at blocking the line.

Panhandle officials say they intend to ask the Supreme Court to reconsider its May 31 action in which the court rejected an appeal by Panhandle from an Appeals court ruling, which held that Panhandle would not be "aggrieved" by American Louisiana's line.

Panhandle's second recourse is to ask a Federal Court of Appeals to rule that Panhandle should have been allowed to intervene in the FPC proceedings in-

NATIONAL *Continuous Weld* LINE PIPE



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Combined they give you a butt-welded line pipe that is always completely uniform throughout—in metallic structure, ductility, strength, corrosion resistance, surface finish and wall thickness. The working of the metal in the exclusive stretch-reduction process, itself, gives NATIONAL Continuous-Weld Line Pipe a better weld and a higher safety factor.

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For further information, write National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

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NATIONAL *Continuous Weld* LINE PIPE

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volving its rival's gas supply. If Panhandle were to win this step, then the company would seek to prove that the producers haven't really offered a "firm" supply of gas for use in the American Louisiana project.

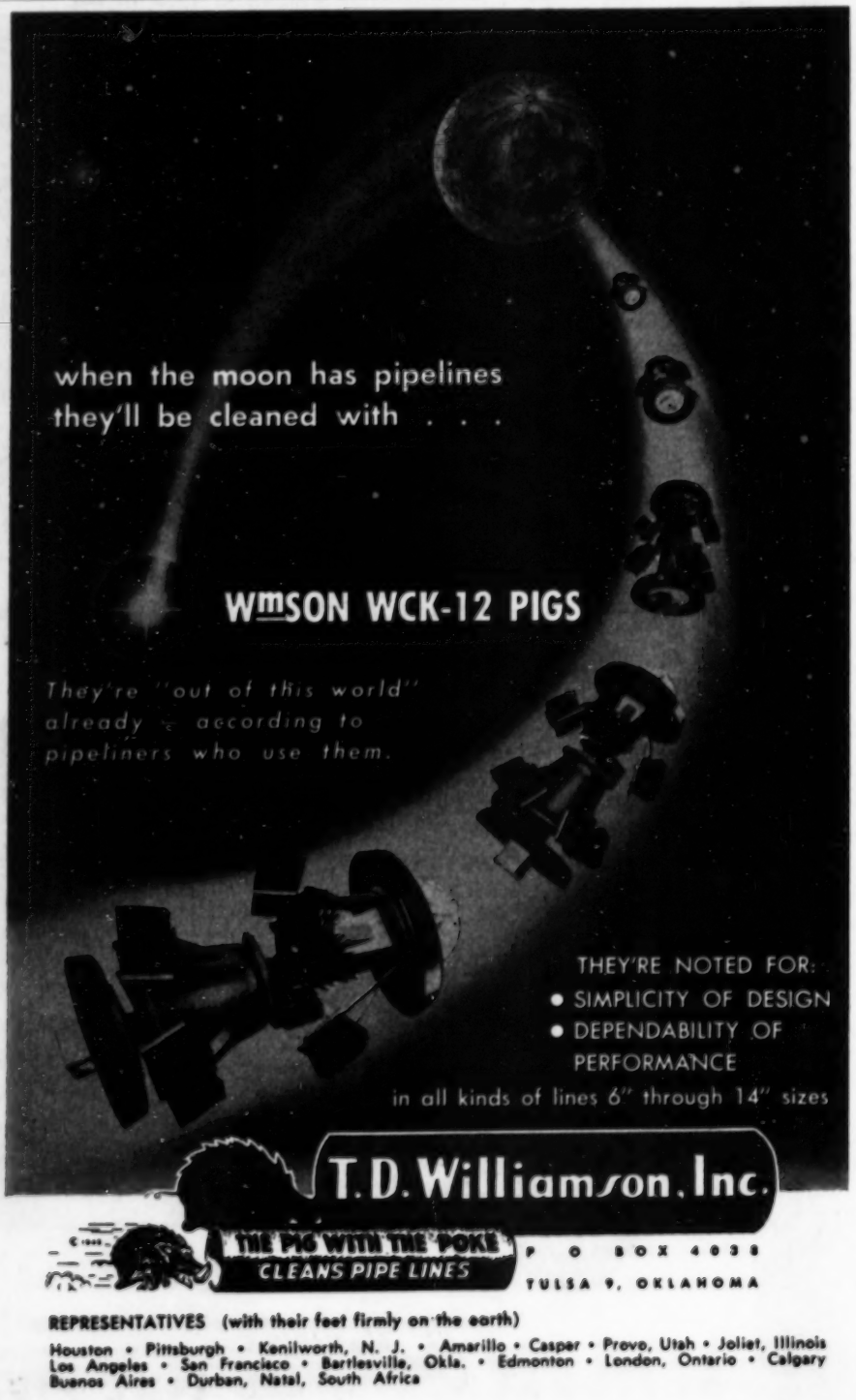
Finally, American Louisiana's proposed financing plan must still be approved by the SEC. It is understood that Panhandle intends to argue before the SEC that the proposed purchase by the parent firm of American Louisiana's stock would violate the Public Utility Holding Company Act.

PG&E will spend $24 million to enlarge Super Inch

Plans for a $24-million enlargement of facilities to import more natural gas for customers of Pacific Gas & Electric Co., San Francisco, were revealed when PG&E filed an application with the California PUC for authorization to begin the project, which would ultimately result in bringing in an additional 225 MMcf of gas per day into northern and central California from Texas and New Mexico fields. (See *GAS*, June, page 155.)

A series of paralleling sections of line, adjacent to the existing 502-mile Super Inch line between Topock, Ariz. and Milpitas, Calif. would virtually complete the construction of a second 24-in. line between those two points. The current project would add 189.8 miles.

The two compressor stations along the line would be increased by the addition of 12,500 in hp, making the compressor capacity total 79,360 hp.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Texas Eastern ordered to supply gas to UGI

Texas Eastern Transmission Co., Shreveport, has been ordered to supply natural gas to United Gas Improvement Co., Philadelphia (Docket G-2573).

The decision, which is subject to review, orders Texas Eastern to supply UGI with a maximum of 3.5 MMcf per day in the 1955-56 winter season, with the total deliveries to be reduced to 712 Mcf daily in the 1957-58 winter. In the meantime, Texas Eastern will be permitted to deliver to UGI any of the peak day gas quantities allocated to other customers which those customers are unable to take—either because of delay in construction of facilities or in development of markets.

Manufacturers Light and Heat Co., Pittsburgh, which now supplies the two divisions of UGI's system for which the supplementary source was being sought from Texas Eastern, intervened in the proceeding in opposition to any allocation to United. Texas Eastern said it was willing to deliver either directly to UGI or to Manufacturers for the use of UGI.

UGI will use the gas purchased from Texas Eastern to convert the Lebanon district of the Harrisburg division from its present mixed gas service to the use of straight natural gas and to supplement gas to be delivered by Manufacturers to UGI's Reading division, now being served with straight natural gas.

Mechanized tape coating available for large pipe

Mechanized tape coating equipment for use on "big inch" lines was announced by Polyken Products, manufacturer of protective tape coatings, at a demonstration before a group of leading pipeline company representatives in Tulsa on July 11.

The new machine, designed jointly by the Remco Manufacturing Co., Tulsa, and Polyken, is expected to give substantial reduction in manpower and machine investment over hot coating methods, according to the manufacturer.

As a part of the Tulsa demonstration, a machine with a capacity of 20

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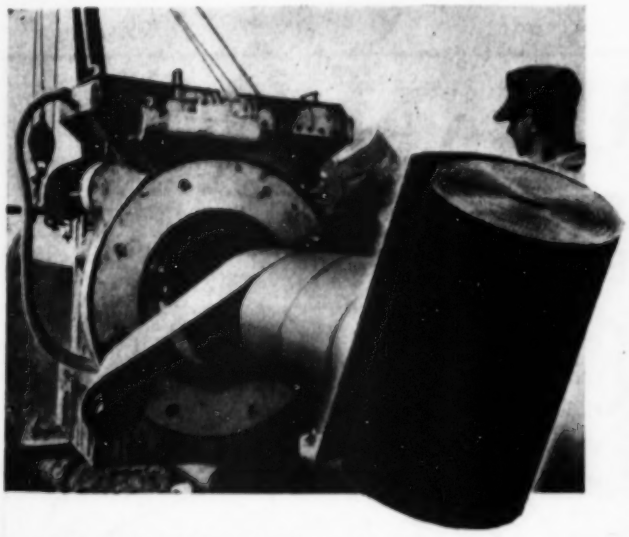
...cut maintenance expense
increase pipe life

TRANSHIELD Asbestos Felt—

This newly developed low cost pipe line protecting wrapper is designed for average soil conditions. It is reinforced with continuous glass yarns, parallel spaced on ¼" centers to give tear-free application strength. Made of coal-tar saturated asbestos, it acts as a continuous barrier to shield pipe line enamels from earth loads and soil stresses.



15-LB. ASBESTOS Pipe Line Felt—

A heavy-duty material particularly suitable for severe soil conditions or where a heavier material than J-M Transhield is desired. Provides long life, toughness, flexibility, resistance to rot, decay, cracking, and impact. J-M 15-lb. Asbestos Felt now protects more than 100,000 miles of oil and gas pipe lines. Widths 2" to 36". Rolls any length desired.

TRANTEX® Polyvinyl Tape—

A widely used coating where ease of application is important . . . over field welded joints of mill-wrapped pipe . . . for rush coating needs. Pressure-sensitive . . . sticks to pipe on contact, forming a firm stable bond. Can be cold-applied by hand or with simple wrapping machines. In rocky soils, an outer wrap of J-M Transhield or J-M 15-lb. Asbestos Pipe Line Felt is recommended.

For further information about Johns-Manville Products for Pipe Line Protection, write to Johns-Manville, Box 60, New York 16, N. Y.; in Canada, 199 Bay St., Toronto I, Ont.

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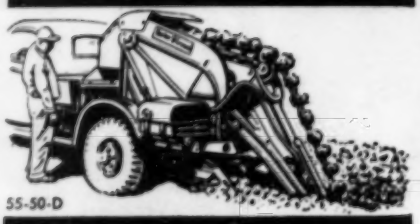

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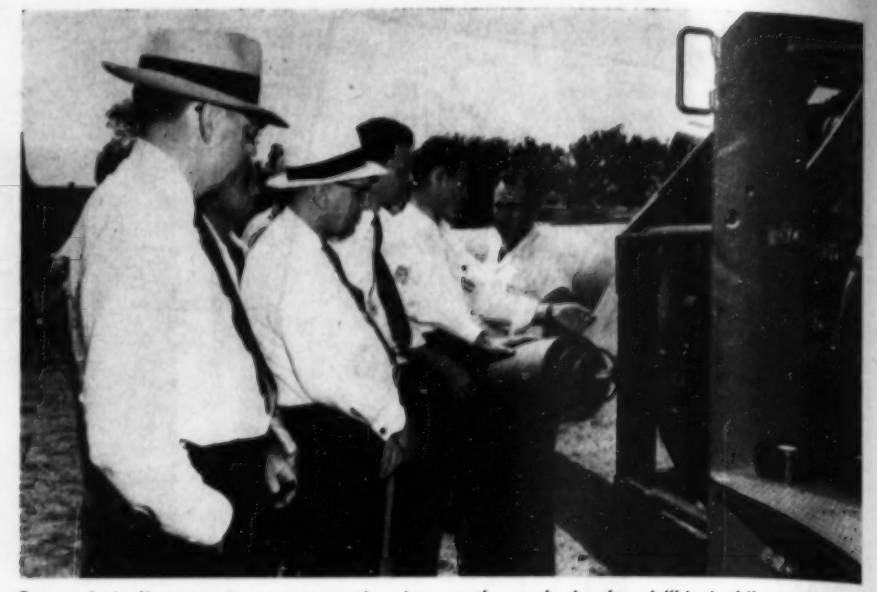


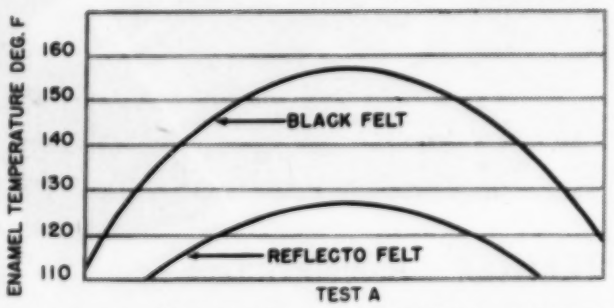
Group of pipeline company representatives inspect the newly developed "big inch" tape wrapping machine recently demonstrated by Polyken Products in Tulsa. Shown (l. to r.): E. G. Wesson and Gene Graff, both of Fish Engineering, Houston; John McIntosh, Allen Cathodic Protection Co., Houston; J. C. Bell, Service Pipeline Co., Tulsa; Dell Nunnally, Polyken Products, Houston; and R. Bender, Pesco, Fort Worth.

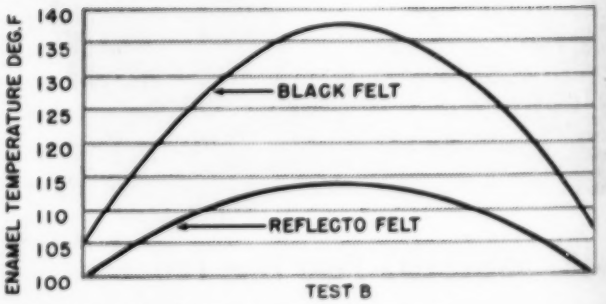
in. to 28 in. was used to wrap a length of 24-in. pipe. Additional equipment for diameters from 12 in. to 36 in. is soon to be made available.

The new machine will tape and overwrap the coating with tar-saturated asbestos felt at operating speeds from 400 ft to 4000 ft per hour.

Polyken tape coatings were originally applied by hand on small diameter pipe. A hand-powered machine was later developed for applying the tape.

REDUCE TEMPERATURE
of ENAMEL as much as 30°
WITH NICOLET REFLECTO-FELT





Above are the results of studies by an independent research organization upon the heat absorption characteristics of Nicolet Reflecto-Felt (white) vs. black felt.

Under controlled surface heat of 140 degrees, enamel under black felt registered 156 degrees. The enamel under Reflecto-Felt registered 126 degrees . . . A TEMPERATURE REDUCTION OF 30 DEGREES.

With controlled surface temperature of TEST A reduced 30%, ENAMEL UNDER REFLECTO-FELT REGISTERED 23 DEGREES LESS THAN ENAMEL UNDER BLACK FELT.

WITH REFLECTO-FELT, YARD WRAPPED PIPE CAN NOW BE STORED. ENAMEL SAG IS REDUCED ON PIPE COATED OVER THE DITCH. INVESTIGATE REFLECTO-FELT NOW. WRITE FOR LITERATURE.

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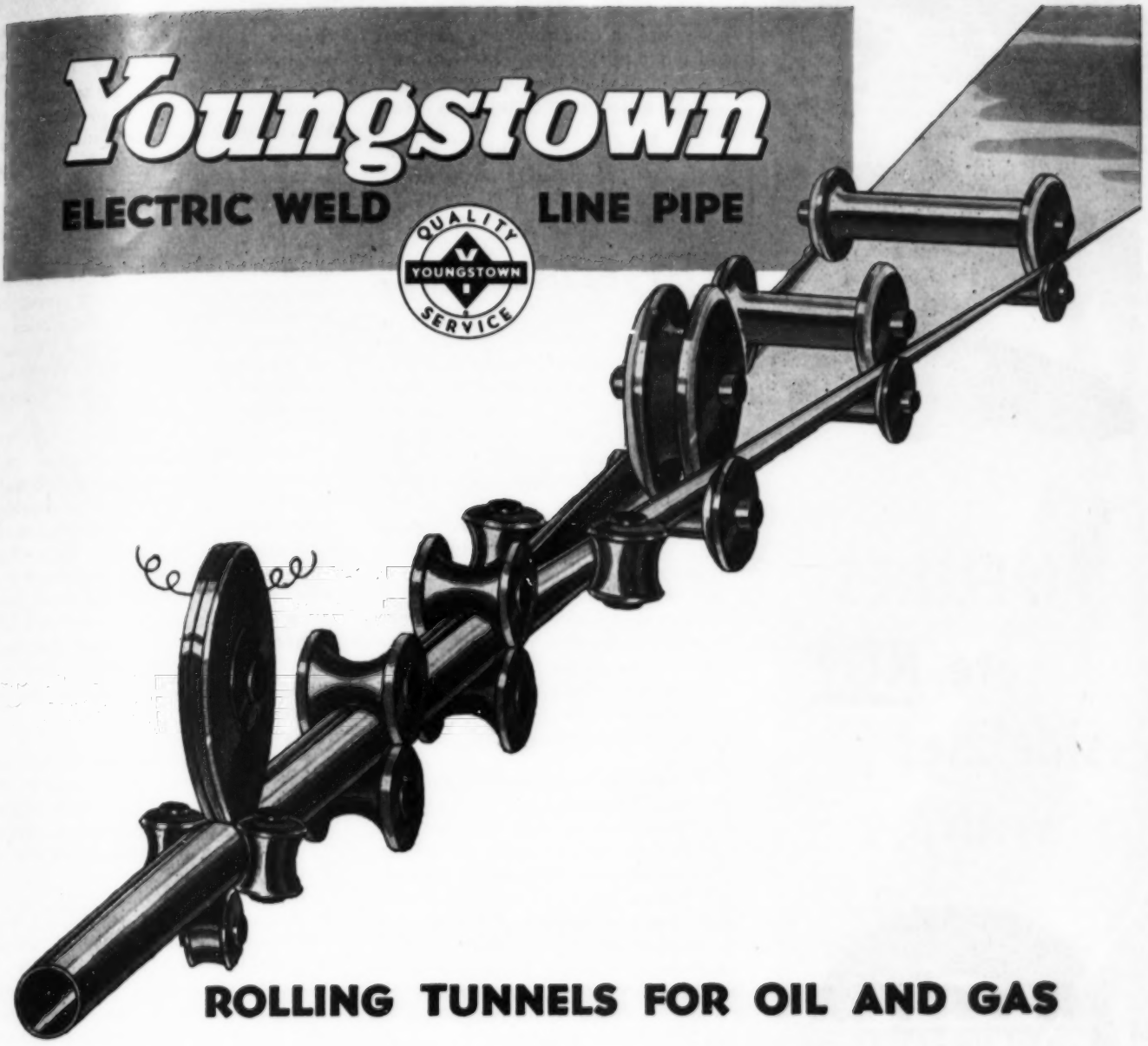

ROLLING TUNNELS FOR OIL AND GAS

Thousands of miles of Youngstown Electric Weld Line Pipe are now serving as tunnels for oil and gas. Synchronized sets of forming rolls shape the steel skelp into tubular form. The completed tube passes from the final forming roll through the electric welder which joins the edges in a solid continuous weld. With rigid quality control continued through the final processing operations, Youngstown Electric Weld Line Pipe is ready to become tunnels for oil and gas.

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Four reasons why Youngstown Electric Weld Line Pipe is your best buy: (1) It bends readily; (2) Wall thickness is uniform; (3) Weldability is outstanding; (4) Long lengths save you time and trouble. The Youngstown Sheet and Tube Company, Youngstown 1, Ohio. Sales and service offices throughout the oil and gas producing areas.

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and in the summer of 1954 the first power-driven machine was designed and put into use. The latter machine was used to wrap the complete municipal gas system of the city of Waynesboro, Ga.

The new big inch machine is an outgrowth of the smaller power-driven unit.

GAS pipeline notes

Ohio Fuel Gas Co., Columbus, has filed an application (Docket G-8752) with the FPC requesting authority to spend $792,400 to construct approximately 19 miles of natural gas pipeline and a new metering station in north central Ohio. The line would enable a connection to be made with a proposed metering station at Lima, where additional gas would be delivered to West Ohio Gas Co.

Rules have been modified by the FPC to permit independent natural gas producers to file on less than 30 days' notice rate schedules reflecting the scheduled Sept. 1 reduction from 9 to 8% in the Texas occupation tax.

Temporary authorization has been granted Trunkline Gas Co., Houston, for construction of eight new compressor stations and 24 miles of line in Texas, Louisiana, Mississippi, Tennessee, and Illinois (Docket G-8664). FPC withheld authority for Trunkline to operate the new facilities pending determination of the proper allocation of the additional sales capacity that will become available upon completion of the $17,686,000 project.

Tod Pazdral Pipeline Specialties, Houston, is now exclusive agent for the Wachs National pipe saw and Wachs guillotine pipe saw in the states of Louisiana, Mississippi, Alabama, Georgia, Florida, and North and South Carolina.

DeLaval Turbine Pacific Co. has moved into its new building in Millbrae, Calif. Within a month the DeLaval Pacific Co. will move from San Francisco into the same new plant.

Nordberg Manufacturing Co., Milwaukee, has appointed Tractor & Equipment Co., Sidney, Mont., as distributor and service headquarters for Nordberg Power Chief diesel and gas engines in the eastern third of Montana and the western quarter of North Dakota.

An $8 million plan has been proposed whereby the Commonwealth Oil Co., Miami, Fla., would acquire the Marine Gathering Co., Houston, as a wholly owned subsidiary. Under the plan, Marine Gathering's stockholders would exchange 100% of their stock for 2,750,000 shares of Commonwealth common stock and a large block of new Commonwealth preferred stock.

Colorado Oil & Gas Corp. has received FPC permission covering an agreement for the sale of gas from the company's Greenwood field properties in Morton county, Kan. Deliveries at the going price in the area of 15 cents per Mcf began last month. Purchaser under the contract is Colorado Interstate Gas Co.

The National Safety Council's certificate of commendation, the first such award ever won in the field of pipeline construction, has been presented to H. C. Price Co., Bartlesville, Okla. The award was made in recognition of the achievement of one of five Price construction units, which worked 434,528 manhours without a single disabling injury from Nov. 20, 1953 to Dec. 31, 1954, setting a new record for the industry.

Westcoast Transmission Co. Ltd. has received an export permit from the Canadian trade and commerce department allowing the company to export 125 billion cu ft of gas a year for 20 years.

New York State Natural Gas Corp., Pittsburgh, has been authorized (Docket G-8568) to build approximately 21 miles of line in Wyoming and Livingston counties, N. Y., which will complete the looping of the company's existing line from Potter county, Pa., to a connection with Rochester Gas & Electric Corp. near Caledonia, N. Y. Estimated cost is $1,225,000.

Certificates have been issued to Clinchfield Coal Corp., Dante, Va., and Kentucky West Virginia Gas Co., Ashland, Ky., authorizing sale of gas by the coal company to the pipeline company (Dockets G-7586 and G-8433). Kentucky West Virginia will construct 32 miles of line to transport gas it will purchase, and Clinchfield will build 16 miles of 12-in. line to move gas produced in southwestern Virginia.

Cities Service Gas Co., Oklahoma City, has permission (Dockets G-8571 and G-8572) to abandon and remove approximately 41 miles of line and construct 39 miles of new line in Missouri and Kansas. The FPC's action covers two applications by Cities Service. Both projects are estimated to cost $1,685,000.

Main Compressor Headers

Natural Gas Storage Company of Illinois Compressor Station, Herscher, Ill.

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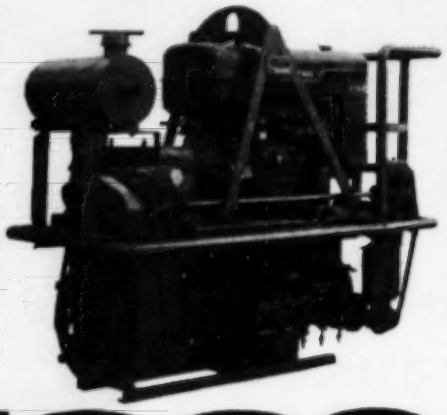
This versatile pipe cleaning and priming machine can be used for line traveling operation or with stationary base (shown at right) for yard cleaning and priming—either way it is better built and more efficient to give you faster, trouble-free service. Crose cleaning and priming machines are available for all sizes of pipe including 36"



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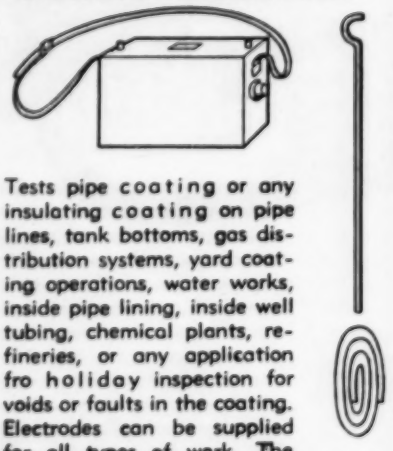

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GAS pipeline people

PHILIP W. METTLING, formerly vice president, has been elevated to president and chief executive officer of C. Lee Cook Co., Louisville, Ky. He succeeds FRED D. DURHAM, who has resigned in order to devote full attention to his duties as president and director of Dover Corp., of which C. Lee Cook is an operating division.

Cooper-Bessemer Corp., Mt. Vernon, Ohio, has appointed C. R. JONES manager of western Canada operations. JOHN MC KISSICK succeeds Mr. Jones as branch manager of the company's Seattle office.

THOMAS G. LEWIS has been appointed assistant to H. H. Waldschmidt, director of purchases for Youngstown (Ohio) Sheet & Tube Co.

RICHARD W. HORNER has been elected a vice president of the Mississippi River Fuel Corp.

CARL K. MOUNT has joined Transcontinental Gas Pipe Line Corp., Houston, as gas contract representative in the gas supply department.

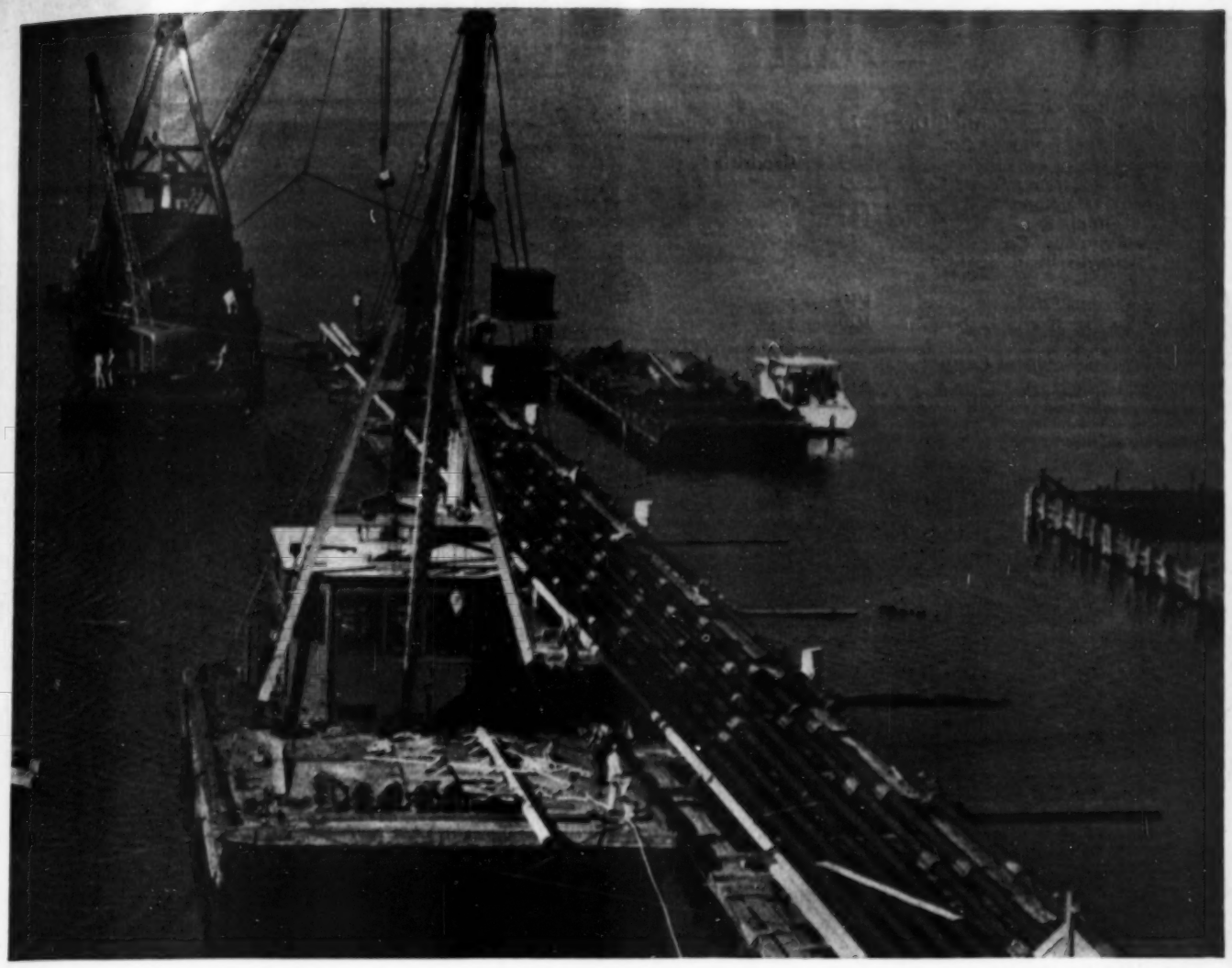
HARRY A. RONAN has been appointed New England regional manager for Motorola Communications and Electronics Inc.

FRED H. DECKMAN has been elected assistant treasurer of the Columbia Gas System Service Corp.

JOHN P. VIGLINI, sernior engineer in transmission engineering, has been appointed assistant chief engineer for the transmission division of Lone Star Gas Co. and Lone Star Producing Co., Dallas.

Equitable Gas Co. has announced that L. E. ROBERTS has been appointed plant superintendent of the company's newest enterprise, the Kentucky Hydrocarbon Co. J. F. SKIDMORE becomes manager of planning and development of Kentucky West Virginia Gas Co., Ashland, Ky.

J. B. Beaird Co., Shreveport, has announced the following changes: RICHARD MEISENBACH, to manager of LPG and anhydrous ammonia equipment sales division; AL BERG, manager of LPG and anhydrous ammonia system sales; CHARLES W. HAYNES, manager dealer storage; ROBERT W. RADEMACHER, assistant manager of plant storage and contract sales in the compressor sales division.



"NO-OX-ID BEATS A BRINY PROBLEM"

There is no environment in nature more corrosive to iron and steel than sea water. That's why proper protection of undersea pipeline installations is so vitally important. The line must be sufficiently shielded to withstand a continuous bath of brine... not for weeks or months, but for many years.

Dearborn's "B-7" specification materials give underwater carrier lines complete protection—the kind of protection they need for long-term, uninterrupted service.

This 10" pipe was mill coated with NO-OX-ID 6X, No. 7 NO-OX-IDized Reinforced Asbestos Wrapper, NO-OX-ID Service Coat No. 15 and kraft paper. The joints were then protected with NO-OX-ID 6X and NO-OX-IDized Wrapper, followed by an application of Rock Shield, banded over the entire surface.

Brine-resisting "B-7" is only one of many NO-OX-ID coating and wrapper combinations. Others provide protection against abrasion, soil stress and moisture absorption...and insulate against electrolytic action. Whatever your pipeline protection problem—there is a NO-OX-ID Coating Combination to do the job...under ground or under water.

Whether applied by hand...by Traveliner...or at the mill, NO-OX-ID Combinations are your best assurance of lasting pipeline protection. On your next job, take advantage of Dearborn's experience —ask for recommendations.

Dearborn NO-OX-ID®

For Long-Term Pipeline Protection

DEARBORN CHEMICAL COMPANY
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